Railway Maintenance Engineer

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Wm. G. McAdoo
Director-General of Railroads

The Director-General's Appeal to Railroad Men

THE Government of the United States having assumed possession and control of the railroads for the period of the present war with Germany, it becomes more than ever obligatory upon every officer and employee of the railroads to apply himself with unreserved energy and unquestioned loyalty to his work.

The supreme interests of the nation have compelled the drafting of a great army of our best young men and sending them to the bloody fields of France to fight for the lives and liberties of those who stay at home.

The sacrifices we are exacting of these noble American boys call to us who stay at home with an irresistible appeal to support them with our most unselfish labor and effort in the work we must do at home, if our armies are to save America from the serious dangers that confront her.

Upon the railroads rests a grave responsibility for the success of the war. The railroads cannot be efficiently operated without the wholehearted and loyal support of every one in the service from the highest to the lowest.

I earnestly appeal to you to apply yourselves with new devotion and energy to your work, to keep trains moving on schedule time and to meet the demands upon the transportation lines, so that our soldiers and sailors may want for nothing which will enable them to fight the enemy to a standstill and win a glorious victory for united America.

Every railroad officer and employee is now, in effect, in the service of the United States, and every officer and employee is just as important a factor in winning the war as the men in uniform who are fighting in the trenches.

I am giving careful consideration to the problems of railroad employees, and every effort will be made to deal with these problems justly and fairly and at the earliest possible moment. There should be a new incentive to every one in railroad service while under Government direction to acquit himself with honor and credit to himself and to the country.

WILLIAM G. McADOO.

Washington, January 8, 1918.

EDITORIALS

SAVING LABOR THROUGH PROPER SELECTION OF MATERIALS

IN CONSIDERING the labor problem in its various phases one should not lose sight of the fact that relief is not secured solely through the substitution of mechanical for manual methods, but that the intelligent selection of materials and devices may accomplish much along the same line. There are many materials which have a long life and, therefore, require the expenditure of labor in renewals at less frequent intervals. There are also numerous devices which are designed to restrain deteriorating influences which would otherwise require the expenditure of labor to overcome the defects.

Take manganese track construction as an example of the first-class. As the life of manganese steel is approximately twice that of open hearth construction it is evident that the labor required for the renewal of frogs, crossings and other special track work built of this material is cut in half by reducing the frequency of renewals in this proportion. At the present time, therefore, the use of materials with long life possesses an importance beyond that under normal conditions and this fact should not be lost sight of. Referring to devices and to rail anchors as a typical example, it is common knowledge that their use prevents rails from running and thereby eliminates the slewing of ties, the crowding of switches, etc., all of which require labor to return them to their original position. In other words, materials of this character act as preventatives, arresting forces which would otherwise require the expenditure of labor to overcome their results. Materials of both of these classes are commonly justified by the direct economies effected, but under present conditions the indirect results through the conservation of labor are frequently of equal or greater benefit.

A DEPARTMENT OF LABOR

THE ENGINEER maintenance of way of a large and well-organized railroad usually has at least two immediate assistants, an engineer of track and an engineer of bridges and buildings, to whom he delegates the details of the work in their respective departments. In view of present conditions it would seem pertinent to suggest a third assistant, an engineer of labor. In spite of the fact that, so far as we know, no road has an officer of this title or duties at the present time, his responsibilities and his work would be greater than those of either of the other two. The critical problem at the present time is not the track or the structures in themselves, but the securing of adequate forces to maintain them.

Among the duties which such a man should assume would be that of recruiting and organizing the forces required. The labor agencies, either company or contract operated, should come under his supervision. He should also have charge of the transfer of forces from one division to another to reduce the waste of labor to the minimum and at the same time to have men on hand when and where needed. He should assume charge of the camps and the facilities necessary for the care of the men, seeing that they are properly built and maintained.

In co-operation with the engineers of track and of bridges and buildings, he should endeavor to install methods to increase the efficiency of the men through prizes, bonus systems, etc. He should also adopt such measures as are necessary to insure an adequate supply of foremen, investigating and installing apprentice courses or such other means of training as would be necessary to insure the maintenance of a sufficient number of men adequately trained to supply any demand which might reasonably be expected. All of these things are being done in a more or less haphazard way on one road or another to-day, but almost without exception there is no definite, systematic plan of action to correlate all of these methods into one broad system. With nearly two million dollars spent for labor in the maintenance of way department every working day, the field would appear to justify the organization of a department to develop the most efficient methods.

FEEDING MEN PROPERLY

TO UNDERSTAND the housing and feeding of laborers it is necessary to understand the men to be fed. Men who work as laborers have only one object in so doing, to earn a living for themselves and for their families, if they have any. With some men this implies only the desire for a bare existence; with others it includes an ambition to get ahead and therefore entails employment that is as nearly permanent as possible. With the latter class the argument for improved feeding and housing is more tangible since it is patent that, other things being equal, the ambitious man will stay on the job as long as it lasts, if the camp is operated and maintained in a manner that makes it attractive.

However, it is an unfortunate fact that the steady man is now offered such an attractive market for his labor that few of this class are now employed in railway extra gangs. Instead, the hobo is typical of a class of men who are a much more important factor in track labor at the present time than they have been for years and no matter how well a camp is conducted they cannot be expected to remain indefinitely on a given job. With the hobo, work is simply the means of obtaining a stake for another spree, and he will work only until he gets it. Consequently, no matter how good the board nor how pleasant the bunk houses, the hobo will not stay much longer than his regular interval. Nevertheless, he appreciates a good camp while he occupies it—the board and the bunks from the one all-important topic of conversation, and the chances are that, if he likes a camp, he will come back to it after he sobers up. Moreover, he will tell his friends about it and the place will be advertised far and wide.

Thus, even with the hobo, improvements in the feeding and housing of men will be found of material benefit. They cannot be expected to produce any marked reduction in the labor turnover, but the good camp will profit through the increased number of applicants for work and the return of men previously employed, so that the gang will

be maintained at much nearer its normal quota of men than the outfit with a bad reputation. This has been demonstrated in numerous well-equipped and efficiently-operated camps like those described on other pages of this issue. To cite a single illustration, the heavy storms taking place in the middle west on January 6 and 12 created an unprecedented demand for laborers to shovel snow, particularly at Chicago. As a consequence, wages of as much as a dollar an hour were offered by some organizations and several railroads paid as much as fifty cents an hour and more. In spite of these conditions, the Pennsylvania Lines and the Illinois Central were able to hold their men on the job, who occupied the camps described in this issue, in the face of offers of much higher wages by other roads. The savings between the standard wages and those which would otherwise have had to be paid to men recruited for this purpose can be credited to the camps.

OUR SOURCES OF LABOR

WHEN EXISTING sources of supply of materials become inadequate to meet the demand it then becomes necessary to search for new sources. This is the condition in which the railways now find themselves with reference to labor. The supply is inadequate for present needs and work is being held up because of inability to secure enough men.

In the past this country has drawn its unskilled labor largely from Europe, but since the beginning of the war this supply has been entirely shut off in so far as the railways are concerned as pointed out on another page. Neither can relief be expected from Mexico. Previous to the enactment of the alien labor law 15,000 to 20,000 men were secured from that country each year, most of whom were engaged in track work. The effect of this legislation, which went into effect on May 1, is shown by the fact that less than 200 Mexican immigrants are now entering the United States monthly. There is always a large supply of cheap labor in the Orient and many suggestions have been made that the United States lower the bars and permit the importation of a sufficient number of these men to meet the demand, possibly under an arrangement whereby they would be returned when the present crisis is passed. However, it is so doubtful if the people of this country would permit such legislation that this source of supply cannot be considered seriously at present. Porto Rico offers another source of relief which, while limited, will be of considerable assistance if the men are distributed properly to meet the most pressing needs.

Much publicity has been given to the employment of women in maintenance of way work and a number of roads have already gone sufficiently far to demonstrate that women may be employed successfully in a considerable variety of work which the maintenance of way department is commonly called upon to perform. Every woman employed in such work releases a man for the heavier and equally essential work. However, it is not to be expected that women will ever constitute any considerable proportion of the maintenance of way employees for the nature of the larger part of the work and the conditions under which they would be required to live are not conducive to their employment.

Considerable relief may also be expected from the intelligent employment of boys of high school age. One eastern road arranged for its track supervisors to speak to the boys in the high schools in the towns along its line last spring, describing the work of track maintenance and pointing out the opportunities for such work. As many as 150 boys from 16 to 18 years of age were secured in this way on a single division, enrolled in special gangs under the direction of experienced track men and assigned to the lighter but equally necessary work of track maintenance. This enabled such regular forces of men as were available to be concentrated on the work of renewing ties, lining and surfacing and similar heavy work.

It is by measures such as these that the roads will be able to maintain their properties during the coming year. Past precedents must in many instances be abandoned. The first consideration is to get the work done and the officer who is most resourceful in developing new sources of supply will have an advantage over his neighbor.

THE STANDARD TRACK WORK SYSTEM

THE ABSENCE of standard methods for the relatively simple as well as for the more complicated tasks results in one of the most serious drains on the efficiency of the maintenance of way department which exists to-day. In general, not enough attention has been given to the analysis of performances to enable one to determine which of several methods is the most economical in time and energy. As a result only the most general instruction and supervision have been given to the manner of performing work and the foremen are left to follow those practices with which they are most familiar. While the loss in a single operation, such as the renewal of a tie, may be almost negligible, when the operation is multiplied many times as actually occurs in a season's work on a large railroad, the loss is sufficiently large in the aggregate to warrant the most careful attention. Studies of performances are of advantage to the laborers as well as to the company, for it has been the almost universal experience that the most efficient way of performing a task is also the easiest, the saving over less efficient methods resulting primarily from the elimination of non-productive lost motion.

Equally serious has been the failure to recognize individual merit among men. The greatest destructive agent of ambition and incentive in the maintenance department has been the flat wage rate for all men in a gang, experienced and inexperienced, good, bad and indifferent alike. As long as a man knows that he gains nothing by extra effort he either falls back to the level of the gang or leaves for other industries where individual merit is recognized. In either instance the road loses the benefit of this extra effort. There is no question but that an experienced man is more valuable to a road, measured both in quality and in quantity of work performed, than an inexperienced one. The same applies when comparing an alert, ambitious man with one whose only aim is to get by. The difficulty has been to recognize this difference in a practical way. In some instances, particularly in the bridge and building department, a graduated wage scale has been installed to compensate for this difference, but it is at best only an approximation and difficult of administration.

The standard track work system provides a more accurate way of indicating the worth of employees. Previous to the determination of the output of a workman it is necessary to determine a unit of measurement. After standard methods have been developed this unit may be determined accurately and for a large number of gangs. The bonus feature may then be applied intelligently to reward efficient effort as indicated by a comparison of the amount of work done with that of the standards.

In the development of a plan of this character it is necessary to compile more records than are customarily prepared. Up to a certain point this is an advantage, as the maintenance of way department has suffered from an almost complete lack of accurate data regarding its performances. While the objection has been raised that the standard track work system as developed on these two roads requires too much clerical work, it is doubtful if these criticisms can be sustained, for experience has shown that the system is not as complicated as it at first appears.

When initiating so revolutionary a plan on any road, certain precautions must be taken. Primary among these is the requisite that the plan have the whole-hearted, sympathetic support of the officers who are to administer it. Without this any departure from existing practices will fail before an opportunity is afforded to demonstrate its real merit. A large amount of skepticism is to be expected from the older foremen and supervisors regarding any plan which savors of theory and this must be overcome in installing the plan by the exercise of tact and by systematic instruction regarding its advantages.

In studying the results of a system such as this it is important to bear in mind that no one measure will overcome all of the evils which now exist. The present conditions have not been brought about by any one deteriorating influence, but are the results of a large number of influences each of which has had its effect on labor.

THE COST OF TRANSIENT LABOR

ONE EASTERN ROAD which has kept a record of the number of men recruited to keep certain of its gangs filled during the past season found that it was necessary to ship over 6,000 men to the work to maintain a force of 600. In other words, 10 men had to be recruited to keep one man in the gang for a period of six months. This is equivalent to a complete change of forces or turnover every 18 days. Another road in the middle west found that 14 men were hired to keep one man at work for a season in its gangs on a division removed from unusual local industrial activity. This road was breaking in an entire new force twice a month.

In view of the present shortage of labor it is instructive to consider the actual cost of such a condition. In the first place, there is the cost of recruiting these men. If a road maintains its own labor bureau, this cost can be determined fairly accurately. If handled through a boarding contractor, the same expense exists, although it may not be so clearly evident. The cost incurred in getting these men onto the work is another very heavy charge, many roads operating one or more cars on certain trains every day during the working season for the sole purpose of carrying laborers to particular jobs. When it is remembered that only a small proportion of the men starting out of a labor center ever go to work in the gangs, the loss in recruiting and in transportation is even more striking.

A more serious loss results from the continued employment of inexperienced men. The training of a man, even though short, constitutes an investment which is lost when that man leaves the service. The most serious drain on the efficiency of the maintenance of way department arises from the continued loss of experienced and semi-experienced men and the substitution of green labor.

Owing to the transitory character of the labor now employed, the men are unable to provide food and lodging for themselves and the companies are required to house and to feed them. Although such provisions were confined originally to those floating gangs which were required by the nature of their work to move from place to place and which were thus prevented from maintaining their own permanent headquarters, the necessity of providing camps has now extended to yard gangs and very commonly even to section gangs. A number of roads have installed cooks and complete camp outfits for gangs of from 6 to 8 men during the last season. In these camps the roads have found it necessary to spend large sums to fit up cars or buildings and to maintain them in proper condition. While the men may be charged the full cost of their board, this is only one element in the cost of maintaining a camp. The provision of transportation for employees of the company or the boarding contractor operating the camp and the free shipment of supplies are typical of many charges which are incurred.

While it is doubtful if any summation of the costs of working transient labor such as those enumerated has ever been made, it would be highly valuable to secure such records in terms of man days of labor employed. Adding these charges and losses to the wages actually paid would then give one a figure approximating the total cost to a road of its maintenance labor per hour or per day and would indicate the amount which a road could afford to pay if it could ascape all of these expenses.

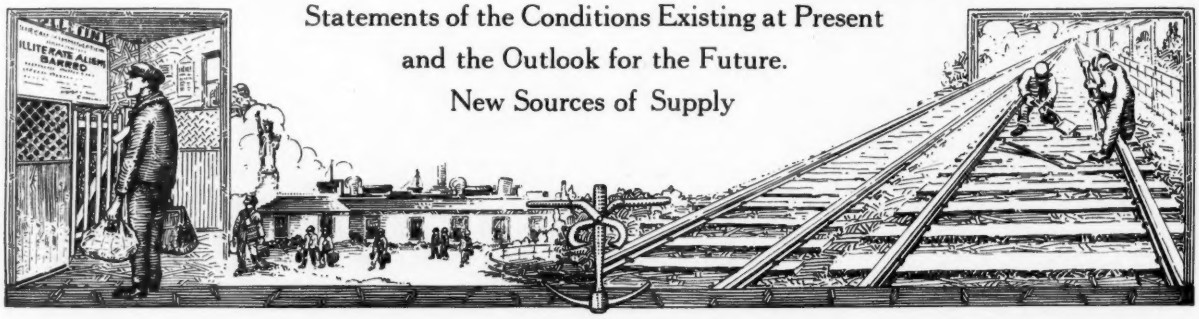
It may be said that these expenses are necessary and inherent to track work, but a careful consideration of the question will not bear this out. It is not many years ago that "bucket" gangs were almost universally employed for all except floating gangs, each man living in the village adjacent to the work and carrying his lunch from his home. The railroad was subjected to no expense for housing this class of men or for transportation to the work. When once enrolled, he usually remained in the gang as long as he was offered employment. Such gangs are not entirely obsolete to-day, although they are decreasing rapidly in number.

Having determined the full cost of the transient labor, even if only approximately, which amount a road could pay to a steady employee without loss to itself, the question arises as to the possibility of securing the necessary number of men if this rate were paid. Many railway men are of the opinion that this cannot be done, emphasizing the large number of men who are required for maintenance of way work. However, the experiences of the few roads who have tried this out more or less experimentally does not bear out this position. Some of the western roads have found that even the relatively small increases offered section laborers this year have attracted native men onto the track in agricultural communities. An eastern road has found that a rate of approximately 35 cents per hour has attracted more labor than it could employ on those portions of its lines passing through farming territories.

The question confronting the roads is not primarily that of paying high wages or low wages, but it is that of conducting its work with the greatest ultimate economy. Many private industries have found that a high labor turnover was suicidal for them and they have adopted measures which were necessary to overcome it. The maintenance of way department of the railroads of this country is now confronted with the same problem. This department is not measured by the wage which is paid, but by the total cost of its work. If a higher wage rate will attract a sufficiently better and more permanent class of men into the service to reduce the costs below those now incurred, obviously it is economical to pay the higher rate. No conclusive answer to this question can be given without extensive trial, but under present conditions no question deserves more careful consideration.

THE MAINTENANCE OF WAY LABOR SITUATION

Statements of the Conditions Existing at Present and the Outlook for the Future. New Sources of Supply



THE LABOR SITUATION is now uppermost in the minds of all maintenance of way men. It overshadows that of delayed deliveries of materials, for in almost every case the amount of work which can be completed is limited by the number of men who can be secured.

An analysis of the situation and of possible sources of supply is a necessary preliminary to the development of labor-saving equipment and of means of conserving the supply. Therefore, in this section of the Labor Number there is presented an analysis of existing conditions by an employee of the Department of Labor conversant with the subject. This is followed by reports from a number of railway men located in different parts of the country, who describe the conditions in their respective areas. Some of the more important difficulties contributing to the present shortage of labor are also presented in three articles prepared by railway maintenance men.

The Railroads and the Labor Crisis

BY HUGH REID,
United States Department of Labor, Washington, D. C.

WE ARE ENTERING the second phase of the war. Last April few men in the United States had any sense of the actual nature of war. In the intervening months grim necessity has done much to clarify our views. We are slowly but surely ridding ourselves of the mass of ideas with regard to war which we have carried over from the days when it was a personal adventure rather than a vast national undertaking. When we entered the war all thoughts were centered in the army and navy. This was in part due to the fact that these are our spectacular services. They are surrounded by the glamour of romance and appeal to the high spirit of adventure. The most striking features of war are the military ones. But they are not the most important.

A hundred years ago it was quite possible for an armed expedition to sail away on a career of conquest and feed itself as it fought. Armies can no longer do this. They must be supported by the "folks at home." Each military unit has behind it a long communicating line which reaches by steamship and railroad to mill, factory and mine. Modern war is really a vast industrial undertaking. We have placed—or shall have by summer—possibly a half million men on the firing line. These men are engaged in destruction. They are in no sense self-supporting. They must be fed, clothed and kept supplied with rifles, shells, ammunition. These supplies cannot be had upon the spot nor can they be produced there. They must be brought from three to six thousand miles. Hence the importance of railroads.

This is the longest line of communications ever employed by any army of great size. It is also perhaps the most vulnerable. The spectacle we shall presently witness includes an army of a million men engaged in destruction, while another army—an industrial one, three to six thousand miles distant, supports them, and in between is a tenuous line of ships and rails over which flow the necessary supplies. It becomes patent that the connecting link is the weakest point. Let the armies at either end be ever so industrious, be ever so brave, nevertheless one is dependent upon the other and neither is stronger than the connecting link—railroads.

AMERICA MUST WIN THE WAR WITH HER RAILROADS

Under such circumstances the supply of labor becomes a matter not only of private concern to those charged with the operation of the roads, but a matter of the gravest public concern. Upon its proper solution lies in great part the success of our arms. Every public agency must, if needed, be called into service to solve the problem. Yet were these agencies to act separately nothing but chaos could result. This was perceived recently by the Council of National Defense when it submitted a plan for what is practically a labor board under a National Labor Administrator. This plan, which was adopted by the President, vests the Secretary of Labor with the necessary powers and charges him with the duties of a labor administrator. His advisory council, just appointed as this article goes to press, is to all intents and purposes a labor board. It has undertaken the problem of supplying labor wherever a shortage exists and of solving all problems in connection with that shortage. This centralized administration will prevent the taking of workers from one war industry to put into another. Much of the labor shortage is due to this industrial robbing of Peter to pay Paul The labor administrator will also deal with strikes and lockouts, dilution of labor, machinery for housing, training of workers and all kindred problems.

Much information has already been gathered, and it is possible at this time to speak with a fair degree of accuracy as to what we expect in the way of labor supply in the next six or eight months. Beyond that period no one can speak with authority, and anyone who under-

takes to tell us what will happen a year hence speaks as a prophet rather than a scientist. But concerning the next six or eight months we can speak with a fair degree of authority. What, then, is the situation with regard to our most vital industry—transportation?

The most serious shortage, numerically at least, will occur in the maintenance of way department. These men are largely unskilled. They are recruited at the bottom of our labor market. Ordinarily they are drawn from a very abundant source—foreign immigration. For a century European laborers have crossed the Atlantic in an ever increasing stream. The year prior to the outbreak of the great European war brought to our shores immigrant aliens to the number of 1,218,480. For the ten years prior to the war (1905-1914) the average number of immigrant aliens was 1,012,194. These furnished our unskilled laborers and as our industries expanded they were soaked up by our vast industrial sponge like so much water. Consider then the difference when during the fiscal year 1915 this annual increase of a million a year—nearly a million and a quarter in the latter years of the decade—suddenly shrank to 326,700. In 1916 the number was even smaller, 298,826. For 1917 the number is again less, 295,403, and the rate continues to decline. Railroad laborers and unskilled workers in general are scarce because our supply has been cut off, while the demand has increased.

Yet these figures do not accurately express the real facts. They relate only to arriving aliens and take no account of departing aliens. These latter are a drain upon the labor supply just as the immigrants are a source of supply. The difference between the two is the real or net supply. Taking these figures, the results are even more startling. The net gain in 1914, for instance, was no less than 769,276. The following year this had dropped to 50,070, a loss of over *93 per cent.* In 1916 the gain was somewhat greater than in 1915 and the net immigration was 125,941. Even then the loss from the 1914 standard was a trifle less than *84 per cent.* It is to be feared that there is little comfort in immigration statistics.

To make matters worse, our present arrivals are of poorer physique than those who formerly came and consequently less fruitful as a source of that sturdy labor necessary for our railroads. Medical inspection reveals double the disabling defects and rejections per thousand in 1915-1916 are increased by 121 per cent over 1914. Every factor seems to bode ill for new acretions of unskilled men.

Railroad labor is recruited from two sources, those classed at ports of entry simply as laborers and those classed as farm laborers. These latter are semi-skilled workers in their native countries, but in America go largely to make up the new recruits for the ranks of common labor. Adding them together, we have our normal source. Only about 90,000 entered the United States in 1916. Over 101,000 left our borders. We are not gaining any laborers; we are as a matter of fact losing them by emigration.

We are thus cut off at the Atlantic. What hope is there to the West and South? Very little. Most of the eastern races are automatically excluded by our statute or by treaty. Mongolian exclusion is a settled policy of long standing and, even were it advisable to abrogate our present laws, the temper of our people is set against the entrance in large numbers of peoples of alien race and customs whom experience has shown us we are incapable of assimilating. Mexican immigration is likewise excluded in great part by several features of the alien labor law, notably the literacy test. At no time have Mexican arrivals reached any considerable numbers and there is small prospect of any large increase. We must face the indubitable fact. The *present labor shortage in the United States must be supplied wholly from within the United States itself.*

This being the case, a survey has been made to show the extent of the demand and the extent of the supply. Upon the basis of this survey the President has chosen W. B. Wilson, Secretary of Labor, to solve the problem of uniting the two. There is every reason to believe that the industries which are in dire need of men will be supplied either from already existing sources of unemployed or by transference from non-essential or less essential businesse or from new sources, all within the United States.

The magnitude of this undertaking can hardly be realized. The estimated demands of transportation alone for the next six months will be 250,000 men. An equal number will be called for in the manufacture of shells, rifles and small arms, machine guns, quick firers and the like. Estimates on shipbuilding total 386,000. Between 60,000 and 75,000 will be required to man the ships. And as the planting and producing season comes on, the farms will cry out for a million men. The total in the divisions enumerated will be somewhat over two millions of men. And yet they are but a part. Other demands will bring the full number to upwards of three and one-half millions—surely a staggering total. And it can be supplied nowhere else save from America.

Our real problem is distribution. Employers themselves are in part responsible for labor shortage. Men with war contracts on their hands have become panic-stricken lest their plants close and have kept standing advertisements in the papers for help. As a result workmen have rushed to these plants in such numbers that there is a surplus of unemployed. Many employers have deliberately planned to keep such a surplus for their own protection, both to insure an adequate supply of

The Labor Situation

The supply of labor is not only of private concern to those charged with the operation of the roads, but it is of the gravest public concern. Upon its proper solution lies in great part the success of our arms. The most serious shortage, numerically at least, will occur in the maintenance of way department.

For the 10 years previous to the war (1905-1914) the average number of immigrant aliens was 1,012,194. In 1917 it fell to 295,403. Deducting the aliens leaving this country, the net gain decreased from 769,276 in 1914 to 50,070 the following year, a loss of over 93 per cent.

The present labor shortage in the United States must be supplied wholly from within the United States itself. Someone must stop competition between employers for man and substitute co-operation. Power has been given the labor administrator to "determine priorities" and rules will be formulated which will amply protect the roads.

Porto Rico is one of the most thickly settled parts of the United States. Were ships available, 100,000 able-bodied laborers could be supplied to American railroads within a week, every one an American citizen. Because of lack of shipping, not more than one-half of these can be brought in by summer.

labor and to keep wages from rising beyond their control. In some cases unemployed men have been kept on the payrolls at nominal sums to insure a continuance of supply. This is, of course, wasteful and must be discontinued. Recently we had the experience of a great city crowed with ship carpenters while other points were helpless by reason of shortage. Someone must stop competition between employers for men and substitute cooperation. The only body which can enforce such cooperation is the Federal Government through its National Labor Administrator.

The machinery for the proper distribution of labor is already in existence. It is in operation and it has been operating successfully for some years. This machinery is the United States Employment Service. Originally organized to help immigrants find work, it has already in existence nearly 100 branches throughout the United States. There will be added to these 114 co-operative state and municipal exchanges. Others are being opened as rapidly as possible.

The demand upon such agencies will be severe, but by no means impossible of satisfaction. Three hundred such agencies supplying an average of 200 men per day can place 3,000,000 men in two months. Several of the agencies are already exceeding this rate and some are doing double. Indeed, it is quite possible that the distributing and training divisions of the United States Employment Service will very nearly supply the total labor requirement for the period. Other means will, however, be employed.

One friutful means will doubtless lie in the greater employment of women. There are many occupations in which men are engaged which demand relatively little physical strength. Many of these occupations, while not unskilled, are nevertheless a drain upon unskilled labor, as they are recruited from common labor when shortages of skilled men are felt. The unskilled men so recruited acquire some skill and never return to the ranks of common labor. The entrance of women into such occupations will release many men who are capable of heavy physical labor.

A still further source will be the withdrawal of men from non-essential industries. The slogan "Business as Usual" is impossible in war time. Business cannot be as usual, because war is an unusual proceeding and military necessity comes first. Manufacturers of luxuries and undertakings useful in nature but not of immediate necessity cannot expect the same consideration as railroads, and large numbers of men will be released by this method. Power has been given the labor administrator to "determine priorities" and rules will be formulated which will amply protect the roads.

Transportation is peculiarly fortunate, however, because of a great reserve nearly all of which can be mobilized for railroad use. Porto Rico is one of the most thickly settled parts of the United States. It is supporting a population nearly 100 per cent greater than it is capable of under present conditions. Were ships available, we could deliver 100,000 able-bodied laborers to American railroads within a week, everyone an American citizen. Because of lack of shipping not more than half of these can be brought in by summer. After that the prospects are brighter, as ships will be launched in increasing numbers. It is, however, gratifying to find 20 per cent of the supply at one point. As the Service believes that it will be substantially able to supply transportation by proper distribution alone, the Porto Rican reserve can be regarded as assuring safety.

Another great reservoir, second in importance only to Porto Rico, is the floating supply in our great cities and in particular Chicago. Labor agencies flourish at such centers and are most wasteful in their operation. By reason of shipment of men to distant points, where many of them desert, the full labor supply is never available. These agencies are being superseded by the one central service of the government. The estimated saving by this method will be about 50,000 men in Chicago alone.

The railroads of America are facing the track labor situation with grave concern. There is no good reason why they should do so. They are too vital to the continued prosecution of the war for the nation to allow them to be crippled by lack of men. On the contrary, there is every reason to believe that their wants will be adequately met. The English situation was far more desperate than ours. Over there, in the first year, they withdrew 5,000,000 men out of a total of 20,000,000 people engaged in gainful occupations. Here we are withdrawing but 1,500,000 for the army out of a total of 35,000,000 employed in gainful occupations. Our drain is only 4 per cent as compared with 25 per cent for our British ally. In other words, we only have one-sixth as many men to replace. And British railroads are still running.

Another aspect which will illustrate the hopeful aspect of the problem is this: We have withdrawn a million and a half of men. Without making any allowances for those drawn from the leisure classes, persons such as students, etc., not normally employed, the total is considerably less than the average number of unemployed persons in the country. There is no necessity for panic on the part of the roads. The government is operating them, and it can be trusted to protect itself. At present there is every reason to believe that the immediate demand will be met. There is, however, the possibility of a great deal of new construction by reason of the new unified control. No one can say whether labor will be available for such work or not. Another complicating factor will be new construction which we must undertake in France. A modern battle is half railroad building. At Cambrai British engineers followed with the advancing troops behind the British barrage and laid rails practically as fast as the troops moved. At the Chemin des Dames approximately 1,000 miles of road were built to win a battle. What new demands these factors will create is problematical. If they are great the American railroad labor situation is indeed serious. If we are to go on with approximately the present demand we are quite safe for the next six months.

STORMS PARALYZE CENTRAL WEST.—Two of the severest snow storms in history swept over the Central West within a week, paralyzing transportation for from 24 to 48 hr. each time. The first storm, on January 5 and 6, was accompanied by a snow fall of nearly 15 in. The railroads were forced to annul most of the passenger trains scheduled to leave Chicago on Sunday, and all incoming trains were late. A second storm passed over the same section of the country Friday evening, the 11th. Passenger trains throughout the storm area were stalled and many important trains could not be moved for from 24 to 48 hr. Practically no trains were run on the 12th and 13, but passenger service was resumed on something approaching normal schedules on January 14. Thousands of men were hired and others were drafted from all railroad departments to clear the tracks. Because of the difficulty of obtaining men for this work, some Chicago roads paid as high as $1 an hour for common labor.

WHAT IS THE MATTER WITH LABOR CONDITIONS?

Two Discussions of Fundamental Reasons for the Present Shortage of Men, With Suggestions for Their Correction

NO PROBLEM confronting the maintenance of way department to-day is more complicated or has more ramifications than that of labor. It is the question which is uppermost at the present time. The existing situation is not the result alone of present industrial conditions; neither has it developed in a day. It is the outcome of a number of influences, some of which have been at work for years and which are only coming into full effect now. The lack of permanent employment, unsatisfactory housing conditions, and methods of feeding the men, their exploitation by labor agents, the failure of wages in the maintenance of way department to keep pace with those in other industries, the limited opportunity for promotion and the lack of any system to reward special effort or individual efficiency are some of the more important influences tending to draw men to other industries and to deter young men from entering the maintenance of way department.

Likewise the solution of this problem will not consist in the adoption of any single remedial measure, but rather in the removal of these various detrimental conditions which have combined to constitute the problem as it now exists. Unfortunately not all railway men have realized this fact fully and as a result they have individually been disappointed when some reform which they have introduced and which has been directed at some one particular abuse has not proved a universal panacea. In a number of instances these reforms are doing all that can reasonably be expected of them and are overcoming the unsatisfactory conditions they were intended to correct. It is by continued progress of this kind, striking at one unsatisfactory condition at a time, that the problem will be solved.

Preparatory to the application of any remedy or series of remedies, it is necessary to secure an accurate diagnosis of the entire situation. The adverse effects of the common methods of hiring men and of feeding and housing them, together with suggested improvements, have been discussed in previous issues. We present below two discussions of other phases of this problem which are of particular interest at the present time.

PERMANENT RESIDENT FORCES ESSENTIAL

By Assistant Chief Engineer

Within the memory of most present day officers in charge of railway track construction and maintenance there was a time when the employees generally were residents along the line, either the heads or the sons of families settled in homes of comfort and moderate plenty, and complacently contemplating an indefinite continuance of their situation. The section foreman's time book showed the same roster of men who needed no identification in the pay car year after year. The track man became a skilled workman. All felt themselves with varying degrees of interest to be substantial units in "their" railroad's permanent family, as, indeed, they were. For the company's prosperity and its physical excellence they properly assumed their shares of credit. The company's prides were their prides and its responsibilities theirs even to the very limit of all affairs within their touch.

Excepting perhaps in a few limited districts this state of affairs has now largely ceased to exist. The change has been gradual to a considerable extent, but since the beginning of the great war it has rapidly developed into a comparatively critical situation. An enormous increase in industrial activity simultaneously with an almost complete cessation of immigration has resulted in a demand for manual labor in excess of the supply. Following a practically unbridled inflation in material prices, industries in competition with one another have advanced wages to a level previously undreamed of.

Wherever this competition extends, and it reaches far, the railroads have had to meet an increasing demand for physical maintenance and improvement with decreased forces, not only as to numbers but also with regard to physical, mental and moral fiber. The steady, resident track employee with a valuable experience and skill and a conscientious regard for duty well done is yielding to the calls of other fields and in his place we have the drifting, inconstant transient, having no ties in the locality of his employment and none linking his continued welfare with that of his employer and whose value as a working unit is but a small per cent of that of his predecessor.

The Value of a Permanent Employee

In any large and permanent industry the greatest efficiency and economy and also the greatest benefit to employee as well as to employer in the long run should follow the securing and holding of a permanent resident force organization, the individuals of which should be home maintainers and citizens in the essential meaning of the term, whose welfare, broadly speaking, is justifiably bound up with that of the industry. And this is our theory, namely, that the only satisfactory force in any department of a railroad is a citizenship permanently resident in the environment of its work. We believe such a theory is scientifically correct, ethical and in the interest of social equilibrium and civilization.

The railroads of this country come nearer perhaps than any other industries to being permanent institutions. Their efficient maintenance and operation and their continued development are matters of paramount national importance. In the face of this urgent fact we find the railroads having to combat a seriously increasing demoralization of their forces due to causes not of their making. Here we confront the ultimate problem itself whose bearings are as wide as the elective franchise and as deep as the roots of progress: "What is due this nation's railroads and their force organizations in general and in particular?"

If our theory is correct we must aim at the conversion of our transient forces into resident forces or as nearly approaching such as possible. We must endeavor to fasten upon them a local interest and, if you please, a pride in their relation to the railroad, and through that cultivating a greater regard for duty from which will come a livelier response to official supervision and control. In order to develop a little local interest on the part of such forces, a great deal of interest must be manifested towards them by the railroad, but the beginning may be the hardest step.

The matter of housing and feeding floating gangs must be dignified into a systematic scientific undertaking. The

idea of providing in a haphazard way assembling, sleeping and eating quarters, crude and comparatively uninviting, must be given over in favor of the establishment of living accommodations that will have a positive appeal. Give these men better care than they seem perhaps now to deserve and surely they will eventually become more deserving or find themselves replaced by those who are more deserving. To accomplish this is not a prohibitive thing, viewed from the basis of dollars and cents outlay and in the end it will surely be profitable, as any improvement in the efficiency of such forces will produce, in the aggregate, a large increase in work achievement, and as it happens happily, will go hand in hand with the increased welfare of the employees.

The providing of the right kind of accommodations is not all. Discipline and morale must be maintained diplomatically and fairly, but positively maintained. Above all, rigid sanitation must be made effective without relaxation. These regulations will seem irksome or helpful to the men according as they are exercised with tact or otherwise. The boarding of the men need not be extravagant, of course, it must not be extravagant; but however simple the victuals, they must be wholesome and palatable and prepared and served in a reasonable variety and in such a way as clearly to indicate a desire to make all meals appetizing and beyond suspicion. This is one of the hardest features to handle without giving just cause for complaint and the boarding must be supervised with an unrelaxing vigilance. These propositions seem hardly to need argument for their support, but there is a great risk of failure between the proposal and the achievement.

HANDLING LABOR REQUIRES CONCENTRATED ATTENTION

Any difficult undertaking that is not the main business of somebody soon becomes nobody's business and is thereby doomed in advance to a large degree of failure. Any railroad company on whose line these untoward conditions largely obtain can well afford to assign a capable officer exclusively to take charge of the housing, feeding and perhaps the employing of its floating forces. An officer adapted to this contingency may not be selected at random. He must be possessed of a sympathetic understanding of human nature and at the same time of a degree of hard-headed practicality that will save him and the situation from running out of balance, either in the direction of softness on one hand or of raw unkindliness on the other. Such an officer would need some assistance and his aides should be selected with an eye to their peculiar fitness just as with their chief. Regardless of whether the bedding and boarding of the men and also the hiring of them is handled indirectly through a commissary contractor or directly by the railroad company, there must not be in appearance or, in fact, any exploiting of the men merely for the purpose of making a profit outside of the gain in efficient performance of work. If the comparative inefficiency of the transient forces now employed can be superseded by a degree of efficiency that will insure something near a normal return of work for the wages paid the gain will many times outmeasure the expenses of the undertaking otherwise unliquidated.

In addition to having provided for proper domiciling we must provide for a reliably permanent force. It would seem natural to conclude that the holding of a permanent force depends upon its having permanent occupation. The exposed nature of railway track work and the effect of climatic changes make this requirement seem harder to satisfy than the requirement of habitation, but to whatever extent work can be provided in the same average quantity throughout the four seasons there will surely result a gratifying availability of reliable forces —which may result in pronounced economy in the long run, even though in the winter season work accomplished will be more costly per unit than in the open seasons. An unloyal man 50 per cent efficient working 9 months in a year makes work more costly than that performed by a loyal man working the year round 90 to 100 per cent efficient 9 months of the year if even at low efficiency due to weather conditions the balance of the year.

Considering particularly regular section labor, the requirement of permanent employment would seem to be met more easily. In most sections of the country we believe the holding of a constant average force on track maintenance and the incidental work required of section men will yield a greater total output of useful work per annum than that obtainable in many localities from the same expenditure crowded into the 9 open months, mainly because of the better grade of men who can thus be secured and held, and partly because there is a great deal of profitable and necessary work that may be done during a large part of the winter season that on many railroads is crowded out during the usual busy season. At all events, when the men laid off at the beginning of the winter are gone for good when again wanted the next spring, the necessity takes on more and more the appearance of a virtue.

The requiring of domiciling in the case of regular section men is properly to be met by the railroad building dwellings, on plats with plenty of room for gardens, these to be rented only to track employees on terms consistent at any time with a proper meeting of the situation. The need of this may not extend beyond a limited number of locations if only permanent employment the year round is assured. Perhaps preferable to a railroad continuing to own such houses, a scheme of selling them to the men on monthly payments deducted from payrolls would work well. Undoubtedly if a regular force of men on each track section was assured of continuous employment throughout the year this would be a great stimulus to the development of a resident supply of men without any necessity for action on the part of the company in the direction of providing homes. On a number of railroads a system of pensioning old or disabled employees is in effect, and where such is the case continuity of service brings the employee within the class of future pensioners, which is a consideration of no little importance to the employee and which forms another link between him and his employer to their mutual benefit.

The forces employed in the maintenance of bridges, buildings, interlockings, fences, etc., come mainly in a different category and with them the matter of domiciling has not, up to this time at least, become a problem, but the provision of continuous employment for them may be given timely consideration.

To sum up the situation it seems to the writer that the maintenance of railway track is a matter of such vital importance as absolutely to demand a *permanent resident* force of trained and loyal operatives in just about the same way that such a force is required in other railway departments. Since the old conditions that naturally or accidentally resulted in our having such a force are giving way to new conditions of opposite effect, we must of necessity arbitrarily create what perhaps may be called equivalent artificial conditions satisfying the theory above set forth, with the hope that in time ultimate causes can be so adjusted to effects as to re-establish the effect of the conditions obtaining in the past.

THE REAL WAGE RATE

By Division Engineer

In any discussion of the maintenance labor problem, it seems to be taken for granted that it is not possible to offer a rate of pay which will compare favorably with that offered in other lines of work. While this is true to a great extent, it is, nevertheless, reasonable to suppose that a careful study of the rate which would be necessary to meet conditions and a careful study of the actual ultimate cost of work under the present arrangement, might show that a higher rate could be considered advantageously. There are many men with experience in track work who would prefer to follow this line, if the wages were anywhere near what they are in other industries. They cannot, however, afford to do so when the rate of pay on the railroad is as much below outside rates, as it is at present.

The Real Wage Rate

In making a study of the rate that would be justified, it would be well to consider the fact that the necessity for furnishing camp and boarding facilities is to a certain extent due to the fact that the rate of pay will not attract local labor. It would be interesting to know to what extent the elimination of camps and bunk cars would justify increasing the rate. In addition to the actual cost of these camps and cars, there is to be considered the fact that providing and maintaining them calls for labor and supervision that could be used advantageously elsewhere. There is the further point to be considered that some of the cars could be used in revenue service and that when these cars are in boarding or bunk service they are often taking up valuable track or yard room. In cases where men who live in bunk cars are working in the same localities with men who live or board outside, the latter class should be favored slightly in the rate of pay. The present practice of paying the same rate to men who are furnished with living quarters and to those who are not is unfair to the men living outside.

In arriving at the actual ultimate cost of work under present conditions, an important item to be considered is the amount of time lost through the men laying off for several days at a time, or through their leaving the service, thus requiring the replacing of them with new men. Some industries have made a detailed study of the actual effect of the losing and replacing of men on the cost of their work. It would be interesting to know what a study of this kind would show when applied to an extra gang which has come to my attention, in which a semi-monthly pay roll carrying 50 names provides an average daily working force of 12 men. I believe that this study would show that a much higher rate would be justified in an attempt to get men who could be depended upon to remain on the work. While at present we are paying a low rate of wage, we are certainly not getting work done cheap.

A further difficulty with the rate of pay, in addition to its being low, is that it is not variable to take care of differences in the efficiency of men, in the class of work being done, or in local conditions as regards the demand and compensation for labor in work outside the railroad. The experienced and steady man should receive some preference over the inexperienced and unreliable one. This preference could take the form of a higher daily rate or of a lump sum added at the end of the month, provided no time has been lost.

The differences in the class of work can be illustrated by a case of which I have knowledge, where in the same locality there are sections on high speed passenger tracks with stone ballast, on slow speed freight main tracks with gravel ballast, in busy switching yards, on stone ballasted tracks with electrified third rail and tunnel tracks with electrified third rail. On all of these sections the same rate is paid for laborers. This gives rise to dissatisfaction among the men, as the men feel that those who are doing the more difficult and dangerous work should be paid accordingly.

No provision is usually made to adjust the rate to meet special outside demands for labor in certain localities, and where a higher rate is allowed the amount of the increase is rarely sufficient to accomplish the purpose desired. To overcome the difficulties which arise from the uniformity of the rate, authority should be granted to some officer in the maintenance of way department, possibly the chief engineer, to allow special rates where conditions warrant it. The present practice of being obliged to adhere rigidly to rates established by executive authority makes it impossible to properly provide for special cases.

The prospects for promotion of laborers in the maintenance of way department do not offer the incentive at the present time that they have in the past, while the pay of foremen and roadmasters does not compare as favorably with that of men working elsewhere in positions of similar responsibility requiring equal experience. This applies not only to work outside railroad service, but even to positions in other departments in railroad work. A man's standing among the men with whom he comes in contact in his work depends, to a large extent, on his salary. In this respect the section foreman and roadmasters are losing ground. While their pay has been increased some, their increase has not been in proportion to that granted in other positions.

There is a good deal of dissatisfaction among regular maintenance laborers on account of the rather common practice of paying them less than is paid to extra gang men working in the same localities. In the great majority of cases this is unfair to the regular men, as they are the more experienced workers and are the ones who are to be depended on in case of emergency. The fact that the regular men have steady work through the winter is no longer a sufficient argument for not paying them as much as is paid to extra men.

Relieve the Roadmaster of Special Duties

In a great many cases the labor problem cannot receive the attention which it needs from the roadmaster and his superiors. These officers, usually overloaded with work even in normal times, are particularly so at present, in view of the large amount of work on hand, together with the scarcity of men and material. It is a very common practice for the roadmaster or his superiors to have to find and hire their own laborers. This frequently necessitates their leaving their routine duties and making long trips to centers of labor supply. To overcome this, all railroads should have departments whose sole duty is to provide labor. This is already being done by some roads with excellent results.

There have been many excellent discussions recently in regard to improved camps and boarding cars. Where, however, the establishing and maintaining of these cars and camps is left to the overburdened roadmaster, the matter cannot receive proper attention. The result is that the laborers are dissatisfied with their living conditions and leave the service. The maintenance of these camps and cars should be entrusted to some one who has time to give the matter proper attention.

Another matter which suffers through lack of suffi-

cient supervision is that of the supply and condition of the tools furnished the men. The kind and condition of the tools with which a man is working has a very important bearing in keeping him satisfied with the work he must do.

The more general use of labor-saving devices, such as rail layers, rail unloaders and mechanical tampers, in addition to reducing the number of men needed, also tends to make conditions more satisfactory to the men on the work. They not only make the work lighter, but there is also a certain fascination for the men in working around mechanical appliances of this kind.

While at the present time the section foreman and the roadmaster are, in general, told to put on all the men they can hire, there has been the tendency in the past which will, no doubt, continue in the future, to make drastic reductions in the number of men allowed, the rate of wage and the number of working hours at the slightest indication of hard times. It goes without saying that work can be done to much better advantage during the so-called hard times, as men and material can be obtained more readily, the quality of men available is better and the work can be done with less interruption to the operating department, as the amount of business being handled is less. A little more liberal policy during these times will result in lasting benefit.

Women in Maintenance Work

UP TO THE TIME that this country entered the war the employment of women in railway service was limited largely to minor clerical positions, stenographers, telephone operators, etc. A few were also employed as draftswomen in division drawing rooms. When it became apparent that the available supply of men was growing steadily less many of the roads decided on the more general employment of women for these light tasks. And as the situation became more acute because of the large number of positions left vacant by men leaving railway service to engage in military pursuits, the scope of the experiment has been widened to include positions involving light labor. As a result of this practice women are now employed to a greater or less extent in practically all branches of railway service. In a tabulation of occupations in which women are engaged, compiled by the Pennsylvania Railroad in November, 1917, and covering the lines east of Pittsburgh, Pa., and Erie, 54 distinct occupations were shown and listed.

The main interest of the maintenance department in these experiments is centered in the results obtained from the employment of women in track work, and while this practice has not become general on any road, but is confined principally to industrial centers where the competition for laborers is keenest, some very interesting methods have been developed by the various roads on which women have been employed extensively.

ARRANGEMENT OF THE WORK

With exceptions it has been the plan to utilize the labor of the women to supplement that of the men, the women doing the lighter work, such as policing, weeding track, mowing the right-of-way, shovel tamping in cinder ballast, etc., and permitting the men to devote their time to the heavier work of renewing ties, laying rails, tamping in stone ballast. In other words, the women have been used chiefly in the work that improved the appearance of the property.

A FLOATING GANG CLEANING TRACKS

In adopting this plan the characteristics of women were considered. By nature they are unsuited to the heavy lifting and carrying required in heavy maintenance work, and by the same token they find pleasure in and are especially fitted for the cleaning-up work they are called upon to do. The results of the plan have been satisfactory both to the railroads and the women. The railways find that in such work the women do as much work as the men and do it better, and the women testify that they like the work as well as any they have ever had.

In planning the scope of their operations other characteristics have had to be considered. It is impossible to

move them from point to point as men may be moved and if they are to be worked at points distant from their homes, arrangements of some nature must be made to get them back at night. To overcome this difficulty some of the railways are utilizing old passenger equipment to transport the women to and from work. This has worked out very satisfactorily as the cars may be utilized to furnish the facilities and comforts that are necessary where women are employed.

The women do not work with the men. Instead they are organized in separate gangs, each gang being in charge of a foreman. In yard and terminal work a single gang may be utilized on two or more sections. Under these conditions their efforts are directed to purely clean-up work. When working on one section only, the scope of their work widens to include tamping in cinder ballast, mowing the right-of-way, and other comparatively light occupations. Floating gangs are used extensively in this

A WOMAN CROSSING WATCHMAN

burgh the work has been more diversified and Polish women have been employed on some of the heavier work. These women are large and muscular and were first employed to clean the grass out of stone ballast. In such work it was found that they did about as much as men similarly engaged. At making stone bank they did more than men, but in the heavy work of tamping track, although the results were in every way satisfactory, the women did not perform as much work as the men.

WOMEN PICKING UP RUBBISH

The Erie has employed women both in large terminals and on the line with satisfactory results. In terminals and yards the women are utilized in unloading cars of rubbish and in policing, weeding, and picking up papers, etc. Generally one gang is worked over one or more sections. The gangs on the line are used chiefly in weeding, dressing up and lining ballast and other clean-up work.

AN EXTRA GANG OF FEMALE LABORERS

more diversified work, but in all cases facilities must be provided for their comforts and for getting them home at night.

The Pennsylvania now has approximately 300 women employed as track laborers on their lines east of Pittsburgh, Pa., and Erie. Generally these are employed in the light clean-up work mentioned above. West of Pitts-

Women are also being used extensively as watchmen at crossings. This work is not particularly arduous, but requires constant attendance on the job. In such work the women have been found efficient. One interesting development of this practice is the utilizing of two women at one crossing, each devoting a half a day to the work, as many not otherwise available are thus attracted.

UNIVERSAL SHORTAGE OF LABOR PREDICTED

Railway Men in Different Parts of the United States and Canada Expect Conditions of Last Year to Be Accentuated

THE SHORTAGE OF LABOR for maintenance of way work has been general throughout the United States and Canada during the last year. The indications are that these conditions will be at least equally acute during 1918. However, the situation varies in its details from one part of the country to another, depending upon local conditions. For this reason we have asked a number of railway men located in different parts of the country to advise us concerning the conditions they have encountered along their lines last year and the indications for 1918. We publish abstracts of these letters below:

PROSPECTS IMPROVING IN NEW ENGLAND

It is practically impossible to tell at this time what the labor situation will be next spring, as it has developed within the last few weeks that a considerable number of men in this territory have been released from outdoor construction and building work, and our forces at the present time are pretty well filled up. If the building work does not open stronger than would appear from the present indications, I believe that our labor shortage will not be quite as serious as it was last year.

We still are able to obtain a large number of "bums" from New York and Boston and have no difficulty in keeping our camps filled, although if a large number of men are drafted within the next three or four months, conditions may be reversed. I do not look for as great activity along the lines of building construction next year, owing to the fact that requirements have been pretty liberally provided for and the extreme difficulty in obtaining necessary materials for carrying on such work in this territory.

W. J. Backes, Engineer Maintenance of Way, New York, New Haven & Hartford, New Haven, Conn.

WILL DEFER NEW WORK IN THE EAST

The labor situation for 1917 has created rather a serious problem. It has been almost impossible to secure sufficient help to meet the maintenance requirements. Fully 50 per cent of the help obtained has been very unsatisfactory and I believe the outlook for 1918 is still more serious. We figure on securing sufficient men to keep up our regular maintenance work, if it is possible to do so, but we do not believe it is going to be possible to secure sufficient men to make any great amount of improvements. We will endeavor to finish up all new work under way and avoid as far as possible the undertaking of new construction for 1918.

A. J. Neafie, Principal Assistant Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

CONDITIONS SERIOUS IN CANADA

Dividing our lines into three grand divisions, the Eastern (all lines east of Toronto), the Ontario (Toronto to St. Clair and the Detroit River and Buffalo to North Bay) and the western (all lines west of St. Clair and the Detroit River), we had the following conditions:

Eastern, labor plentiful.

Ontario, labor scarce.

Western, labor fair.

However, we could not obtain the normal number of trackmen at schedule rates on any part of our system and in some cases, particularly on the Ontario Lines, we had to pay 35 to 50 per cent more than schedule rates, the average on the Eastern and Western Lines being 25 per cent more than the schdule rate.

The following shows the number of men obtained at schedule and higher than schedule rates:

	Schedule Rates, Per Cent	Higher Rates, Per Cent	Total of Normal, Per Cent
Eastern	61	54	115
Ontario	48	27	75
Western	31	61	92

It will thus be seen that on the Eastern Lines we obtained 15 per cent over the normal number of maintenance men, on Ontario 25 per cent under, and on the Western lines 8 per cent normal. The principal cause for the greater number of men on Eastern Lines is that a very large proportion of the lines are in the Province of Quebec.

We do not expect any improvement in 1918; in fact, we anticipate a greater shortage or higher wages than in 1917. There are a large number of laborers yet in the country if one is willing to pay the price to secure them from other industries, or if the Government will permit us more than just sufficient to keep things safe. We are not making any plans for 1918 beyond trying to keep those of our old force which we have, as we do not believe that any work will be undertaken other than strictly maintenance owing to the high prices and the difficulty in obtaining materials.

M. S. Blaiklock, Engineer Maintenance of Way, Grand Trunk, Montreal, Que.

CONDITIONS IN THE PITTSBURGH DISTRICT

At the beginning of 1917 there was a very great shortage of men in the maintenance of way departments of all the roads in this district. Wages were much below the market price of labor in competing industries and what labor was shipped in by the railroads was lost quickly because of the higher wages to be had at every turn. Until spring common labor was made up almost entirely of Austrians, Slavs, Hungarians, Poles, Roumanians and Italians. The hobo was almost unknown and the negro was the exception. Few of the roads had any arrangements for feeding men and the camp conditions were, if anything, below the average.

Early in the season a number of the roads started to use hobo labor, made provision for feeding men, and improved the conditions of the camps. A few of the roads imported negroes in large numbers. The high wages offered in the mines, factories and mills drew men from all parts of the United States and late in the summer the supply of common labor approached the demand and as a result the fall and winter finds the roads with a fair supply of force, but it is only held by putting up with an alarming turn-over, with the consequent disorganization and lessened efficiency.

For 1918 it is probable that the usual amount of maintenance of way work will be done in this district and it is more than likely that a large mileage of branch lines to coal mines and extensions of industry tracks will be built. It is certain that a large amount of additional

terminal work is needed and it is probable that considerable labor will be required on it.

The outlook for 1918 is that there will be sufficient labor in this district for roads paying anything like the market price of labor, providing they are willing to maintain fair camps, feed the men, either by commissaries of their own or by contract, and put up with a turn-over of half the force every pay day.

The facts are there are sufficient men in this district to take care of any necessary work, and it is probable there are enough to take care of any work that is likely to come up. The great problem is to hold these men on the job. Pay day and the day after are sure to be a blank for half of the force in large gangs. If the whole district could be made dry it is probable that the railroads would have little trouble meeting next year's work with the force now here.

On sections it is extremely difficult to hold men as most of them must be housed and fed by the company. Under present conditions it seems that the only solution for this is to establish camps at convenient points and to distribute the men daily over the division and haul them back again at night. This is, of course, expensive and inefficient.

Most of the roads have met the wage question squarely and are paying the average market price, but a few roads are still paying low wages and depending on contractors who work on a cost plus a percentage, or are making their men allowances of overtime, etc. Both of these practices are wrong and can only lead to disappointment. Authority passes from the foreman to some gang leader and the cost is probably greater than if the higher rate were paid. *Trackman.*

NEGRO EXODUS SERIOUS IN THE SOUTH

The labor outlook for 1918 is discouraging. On account of this the amount of improvement work, outside of what can be done largely by machinery, will be very limited. In maintenance work the question is equally serious. Negro labor is the only supply in the section traversed by our lines and the heavy exodus of this class of labor to the North, combined with unusual industrial activity in the South, presents to the railroads a problem of very grave concern.

C. E. Weaver, Engineer Maintenance of Way, Central of Georgia, Savannah, Ga.

DOING ALL WORK POSSIBLE IN WINTER

Our troubles practically began with the breaking out of the war, or very shortly thereafter. Many negroes migrated toward the North to take the place of laborers who had found more profitable employment, or who had returned to their native country to take part in the war. This exodus continued for some time, but it has not been very noticeable within the past six months. However, in place of this there has been the draft and the organization of volunteer regiments as well as the almost universal tendency of railroad labor to seek shorter hours and higher wages in the adjacent manufacturing and industrial plants. We have so far experienced very little trouble in securing the labor needed during the winter months. At this time we are able to do some work, but it is not as effective as in the summer months.

From the time planting begins to the gathering of the crops we have experienced, and expect to experience considerable shortage. On some divisions we find it absolutely necessary to keep up our track with extra gangs, quartered in boarding cars which can be moved from place to place as circumstances require. The fact that we board our men makes it possible for us to maintain a larger force than would otherwise be the case. It is our purpose to do all the work possible during the winter months in anticipation of a shortage in the spring, summer and fall. The losses which we have already sustained in our organization seem to me to make it imperative that the government should take some steps to prevent the further depletion of the skilled and trained help of the railroad.

Hunter McDonald, Chief Engineer, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

WILL ATTEMPT TO DO NECESSARY MAINTENANCE WORK

During the past year we had very extensive rail and ballast programs authorized, but the scarcity of labor, combined with the inability of the steel companies to deliver rail, resulted in reducing greatly the amount of work that it was expected to do. Early, and even before the working season commenced, we endeavored to recruit large track forces, shipping many Mexicans from the Southwest throughout our territory, providing them with facilities for housing themselves and their families. During the early part of the season we succeeded in securing a fairly good force. With the advent of the draft law these Mexicans, as well as other foreigners which we were able to obtain, scattered like sheep and a very large percentage of them returned to their own country. This left us entirely dependent upon the local labor supply with such few men around large cities and foreigners as we were able to secure from time to time.

Coupled with the labor shortage, the various railroad companies resumed their competition in the way of wage increases to secure the available men, and this competition, together with the economic conditions, resulted in a wage increase of approximately 30 per cent in track forces.

During the latter part of the season, due to the organization of the national army, as well as the large labor demand throughout the country for the building of cantonments and for industrial enterprises, there was a greatly restricted force in the track department and on some territories there were but few men with which to carry on the work.

I think the labor situation during the present year will be a far more difficult problem for the railroad companies than in the preceding year. Larger inroads are going to be made in the further development of our army and navy, as well as in industrial enterprises and as track labor is the lowest paid labor, it is going to be very scarce unless the situation is controlled in some way through the direction of the federal government.

This company will attempt to secure as much Mexican and local labor as it is possible to secure. Further, some thought is being given to recruiting high school students, locating them in camps under conditions which it is hoped can be made satisfactory. In addition to this, we are contemplating, at the larger terminals, establishing quarters for the men that will be made attractive as possible under the circumstances. We hope that this, together with the use of motor cars throughout our lines and other labor-saving devices, will result in securing a reasonable amount of labor as well as a continuation of the necessary maintenance work with proper forces. Without question the rate of wage is going to have to be increased materially in order to secure such labor.

As the government has now taken over the railroads, it is not possible to determine the amount of improvement work contemplated by this company. We had hoped to

carry on a large program, both in laying new rail and in laying second-hand rail in minor main and important branch lines, and also to carry on a large ballast program, as well as making the usual addition and betterment expenditures necessary for the proper upkeep of this property. As to just how far this will be carried on it is impossible at this time to state, but it is hoped that the labor and financial conditions will be such that we can make material improvements in the tracks of this company, as well as to carry on the betterment work which is needed in connection with the maintenance of same.

H. G. Clark, Assistant to Vice-President, Chicago, Rock Island & Pacific, Chicago.

AMPLE SUPPLY OF LABOR IN 1917

During 1917 the labor problem was not especially serious with us. While we had some difficulty in getting sufficient labor on certain portions of the line, on the whole the quantity of labor was adequate and was sufficient to permit our completing in fair season all of the work contemplated, except bridge and building work, which suffered on account of a shortage of help.

During 1917 section forces ranged between 7,300 laborers for the month of June and 3,400 for the month of December, compared with 7,500 for the month of June and 4,050 for the month of December, 1916. Bridge and building forces ranged, for the year 1917, between 1,450 for the month of July and 1,160 for the month of December, compared with 1,670 for the month of June and 1,240 for the month of December, 1916.

In the territory where our forces are drawn largely from the surrounding country, both the track and building and bridge forces generally have been adequate, but on those portions of our line where the local supply of help is limited and to which portions of the line shipments of labor must be made from labor centers, chiefly large cities, there has been a shortage of help.

The outlook for 1918 is not as good as was that at this time in 1917. We would not be surprised if the supply of available labor is reduced 25 per cent. To make good the shortage occurring last year in Montana and in states west of Montana an effort was made to induce Mexican and negro laborers to accept service on our lines, but this effort did not meet with much success, our lines appearing to be too far north to attract laborers of these classes. No attempt has been made as yet to employ women.

J. R. W. Davis, Engineer Maintenance of Way, Great Northern, St. Paul, Minn.

SERIOUS SHORTAGE EXPECTED IN COLORADO

The railway labor problem is assuming serious proportions with us and its solution is causing considerable anxiety. The lateness of the season has been a boon in that the shortage of the past year has been partially compensated by the longer working season. Now that the crops have long since been harvested, the open weather which has prevailed permits a certain amount of railway work to be done which otherwise would not be possible. Similarly next spring much of the success in doing the urgent and necessary work will depend upon seasonal weather conditions. Undoubtedly there will be no large movements of labor between localities, and the demand will probably have to be supplied from relatively local points. Rates of pay will evidently have little effect either upon quantity or quality, although higher compensation in some degree will be a necessity. Labor-saving devices and all available ingenuity for the elimination of manual power will have to be brought into use, and even with such aid there is grave concern that expected results will not be forthcoming, for there is a certain minimum in laboring forces below which further conservation is impossible. We do not expect, therefore, to be able to keep maintenance expenses down to a normal proportion and, in fact, ought not to curtail any expenditures necessary to the successful and expeditious movement of our traffic.

It now seems quite likely that only such improvements will be undertaken as are urgently demanded for the prompt dispatch for increased capacity in transportation, enabling us to confine our endeavors in using to the utmost such fixed plant facilities as are at our disposal.

Arthur Ridgway, Assistant Chief Engineer, Denver & Rio Grande, Denver, Colo.

MUCH WORK TO BE DONE IN THE NORTHWEST

Labor conditions on this road were very bad during 1917, applying to territory in Northern Utah, Western Wyoming, Southern Montana, Southern Idaho and Eastern Oregon. The shortage of labor not only applied to the railroads, but to the farmers and ranchers as well, and the construction of several sugar factories as well as considerable municipal work drew heavily upon what labor there was, as these industries, of course, pay a higher rate for short time rush jobs than the railroads can afford to pay for regular routine work.

The early winter was a remarkable one, because of the lack of storms and severe cold weather; therefore, much of the summer season's work which had to be deferred because labor was not obtainable, has been completed during the months of November and December, when heavy snow and cold weather ordinarily prevent track work and outside construction work being done. Within the past few days the situation has changed and it appears that regular winter weather is upon us; therefore, while the labor situation just at the moment is easy, outside work will necessarily have to be abandoned, at least temporarily.

Military service has, of course, drawn heavily upon our regular forces and further drafts will draw more heavily; also the regular demands for industrial and agricultural needs will probably be as heavy in 1918 as they were in 1917 and this demand will make itself felt probably from May 1 to December 1.

Southern lines which can carry on their track and outside construction work throughout the 12 months of the year, can arrange their work and plan for practically continuous forces throughout the year; also, they may more readily draw on Mexico and the colored men of the South. Northern lines, less favored geographically, are confronted with a more serious problem. I believe they would favor legislation that would permit the importation of foreigners under guarantee of return whenever their services were not further needed. They also would appreciate legislation that would permit the moving of large gangs of colored men to the North in the spring and the returning of them to the southern states in the fall on free transportation. This is somewhat idealistic and could best be handled through some co-operative arrangement between southern and northern railroads, so that southern roads might do their heavy work in the winter time and northern roads their heavy work in the summertime.

This railroad, as one of the units of the Union Pacific System, handles a tremendously heavy traffic and must be maintained to very high western standards; therefore, the maintenance department is confronted this year, as every year, with a great deal of work absolutely necessary to the safe maintenance of tracks and struct-

ures, so that while we are of necessity accepting graciously the federal regulations which have come upon us, we are optimistic that the federal officers will see the necessity for maintaining our railroad safely. Therefore we feel that the demand for laborers on our road will be practically as heavy in 1918 as in 1917, and at the present time we can see no means of obtaining laborers, except those which we have combed over thoroughly in the past two years.

R. B. Robinson, Engineer Maintenance of Way, Oregon Short Line, Pocatello, Idaho.

NO CHANGE IN SOUTHWEST

There is nothing new to report in the railway maintenance labor situation in this vicinity. We depend entirely on Mexican labor for track work. Laborers are still somewhat difficult to secure and our forces are not up to the full number.

J. L. Campbell, Engineer Maintenance of Way, El Paso & Southwestern.

SIXTY PER CENT FORCE IN SUMMER

Starting with last June, we began to experience a serious shortage and falling off in our maintenance labor supply, and by September we had but about 60 per cent of the normal supply for that time of year. This condition was brought about by two causes: (1) The general shortage prevalent the country over, and (2) seasonal occupations, such as farming, lumbering, etc., drew heavily from our forces on account of the attractive wages which these industries were able to offer for a few months.

Beginning with October, we began to note slight increases in our forces, with still further accessions in November and December. We are now working probably about 80 per cent of normal forces. We anticipate that we will run on about that percentage until about next May, when we expect a repetition of the severe shortage of labor as last summer. All this means that nothing but the most imperative betterment or addition work can be undertaken, and that the bulk of such forces as are available must be devoted to current maintenance; even with this concentration, there is accruing, and will continue to accrue, a considerable amount of deferred maintenance. On account of our previous good physical condition the deferred maintenance so far has not affected us very much, although it is bound to be a matter of increasing concern the longer the present abnormal conditions prevail.

J. Q. Barlow, Assistant Chief Engineer, Southern Pacific.

SUPPLY OF MEXICANS SHUT OFF

This company has a contract with an agency to furnish Mexican track labor on the Coast Lines, with the privileges of selling them supplies. Prior to the imposition of the head tax and the literacy test, this company furnished a large part of our Mexican track laborers from Mexico. However, at the present time this company cannot secure men from Mexico and has to depend largely upon the Mexican labor which is now in this country.

During the summer and the latter part of 1917, this company could furnish very few men, with the result that we were not able to do any of the second track construction work which had been planned, nor were we able to keep the sections full enough to maintain the track properly. In California the farmers would drive up to the section houses and take the men away. For a long time we had a number of sections without any men, and for that matter we have some sections in the same condition even now.

The farmer, the contractor and the highways were able to pay more money for Mexican labor than the railway companies. As a matter of fact, there was not enough to go around, and had we attempted to meet their price it would only have caused them to make a further increase. We are now furnishing better houses and better living conditions for track laborers, and it is hoped that if we can get married men well established in these houses, we can hold enough of them to keep up the ordinary track maintenance. The single men, after being in this country, like a contractor's camp or some place where meals are served. They are getting more and more away from the home cooking idea, which makes it more difficult to hold them on sections.

We were also short of bridge men and tower and bridge tenders, and practically all of our 1917 work was delayed, while some of it was held up or abandoned, owing to inability to keep as many men as the work required. We succeeded in getting through 1917 in fairly good shape by increasing salaries and by contracting the important work which had to be done, allowing the contractor to pay what he had to in order to get the work done. At the present time the labor situation has eased up a little, owing to the fact that the farmers and fruit men are not employing much labor.

At the present writing we are in good shape with regard to track labor in New Mexico, owing largely to the use of Indian labor. We are also supplied with Mexican labor in Arizona. In California there is still a shortage, but not so severe. A large part of our section gangs are filled up, and we are able to maintain a few extra gangs, although there still existed a heavy shortage in track labor on the San Juoaqun Valley division. We are at the present time in fairly good shape with regard to bridge men and other classes of maintenance employees.

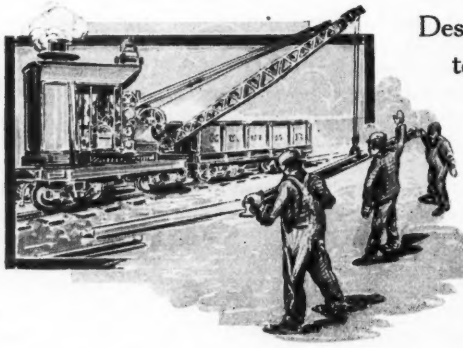
The outlook for 1918 is very poor. It is hoped that we can get in more tie renewals, complete the second track now under way, change out the rail which is needed and finish up those things which have to be done before the summer demand for labor by the farmer and fruit raiser becomes acute. In 1917 any special work which had to be done was contracted, mostly on a force account basis, and the contractor was allowed to pay whatever was necessary to get labor. This varied from $3 to $3.50 for eight and nine hours' work for ordinary Mexican labor.

The only new labor which we have developed has been from the New Mexico Indians. For a great many years we have used some of this labor on the sections, and in years past we used them in extra gangs, but while the labor agent was able to furnish the Mexican labor, the Indians were not taken very far from home. We are now running those Indian extra gangs into Arizona and we may have to bring them into California.

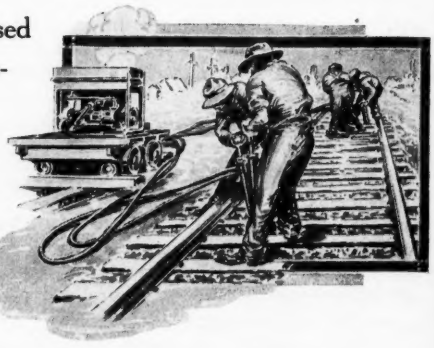
All work, such as the extension of sidings and new tracks, is largely held up owing to the shortage of rail, and if undertaken will have to be completed within the next 60 days. We have not planned very much new work for 1918 and even the small amount which we have under way is very difficult to handle by contract because the contractors do not know how to figure on the labor situation. We expect to do as little extra work as is possible and will attempt to get the maintenance in such shape within the next 60 days that we can carry the road through the summer with the few men which we will be able to hold.

G. W. Harris, Chief Engineer, Coast Lines, Atchison, Topeka & Santa Fe, Los Angeles, Cal.

HANDLING MAINTENANCE WORK WITH LESS MEN



Descriptions of Devices Used to Save Labor and Discussions of Opportunities for Further Developments



ONE OF THE MOST effective ways in which the present acute shortage of labor can be alleviated is through the more extensive application of mechanical appliances to the work which the maintenance of way department is required to handle. This department has been very backward in the development of equipment to replace men and the application of appliances already in use in other industries to the problems of track and structures. A large variety of work is capable of mechanical performance and present conditions offer an unusual incentive for the concentration of attention to this subject. For this reason we have collected in this section of the Labor Number three articles prepared by practical railway men, pointing out the work which they are called upon to perform for which mechanical help is desirable and not yet available. Following these discussions we are publishing a number of descriptions of recent developments in this field which are capable of more or less general application and which will aid in increasing the output of work per man.

DOING TRACK WORK MECHANICALLY

By Supervisor

On account of the present scarcity of maintenance of way labor and the comparative inefficiency of that which is available, the increased introduction and use of labor-saving machines and devices for maintenance work is a development very much to be desired. However, the introduction and use of devices of this kind cannot be accomplished to any great extent unless both the people who will buy them and the people who will use them are shown clearly that profit of some kind will result. The men who control the purchases must be shown that their organizations will be bettered and the men who are to use and operate them must be shown what benefits should result to them from their use and the proper way to secure them.

A short review of what may be called the operations that go to make up the different kinds of work done by maintenance of way labor gangs and that will bring out the items of work which offer the greatest opportunities for savings if done by mechanical means should be of use as a guide to those lines in which the greatest efforts should be made. It is proper to consider not only mechanical means for performing work which will effect a direct saving of labor, but also devices which, when applied, will eliminate work which has formerly been necessary and in this way effect an indirect but at the same time fully as real a saving of labor.

Maintenance of way labor gangs are called upon at one time or another to do work of almost an infinite variety. The greatest part of this work is of a routine character and it is in work of this kind that it should be most profitable to replace with labor-saving appliances. The routine work of the usual gang can be covered under two general headings: (1) The work done directly on the track structure, such as the renewal of ties, rail, switches, frogs and other track material, the work of maintaining surface, line and gage, and the cleaning of ballast, and (2) the work not directly concerned with the track structure, such as mowing the right-of-way and the removal of snow and ice from the tracks.

Operations in Renewals.

In the first place the work that is done during renewals should be considered. For the renewal of a tie the operations include digging out the ballast, pulling the spikes, removing the old tie, installing the new tie, tamping, spiking and dressing up. For the renewal of rail the operations include the pulling of the spikes, removing the bolts and splices, taking out the old rail, putting in the new rail, applying the new splices, which includes the tightening of the bolts, spiking and dressing up. For the renewal of frogs, switches and other track material, the operations are much the same as in the case of rail, that is, loosening the old material by pulling the spikes or removing the bolts, or both, setting out the old and setting in the new material and fastening the new material by driving spikes or applying bolts, or both. The work of maintaining surface, line and gage is enough different from renewal work that it should be considered by itself. Surfacing and lining track vary in relative importance in different locations, but whether the lining or the surfacing work is of greater importance, a great deal of both is done during a season. To surface track requires that some ballast be dug away from the ties, a short portion of the track raised with a bar or jack and the ballast then driven under the ties. The lining of the track may or may not require that the ballast be loosened from the tie in addition to the application of a strong force on the rails at the place to be lined. To gage track spikes are pulled, the tie may be adzed, the rail is forced into its new position and spiked down. The work of cleaning ballast is of a still different character and requires the forking of the ballast so as to separate the dirt from the ballast and some means for disposing of the dirt.

Certain Operations Performed Repeatedly.

In this short review of routine work that is done directly on the track structure, the pulling and driving of

spikes, the removing and installing of bolts and the lifting out and lifting in of material occur over and over again. Tamping ties occurs both in installing them and in surfacing track. These simple items of work stand out by themselves because of their endless repetition.

Attention is attracted first to the pulling and driving of spikes in practically every operation. To pull or to drive one spike is a very small piece of work. However, the great number of spikes pulled and driven makes it possible to realize a large saving in labor by doing this mechanically. This saving of labor is real and not theoretical or imaginary and of sufficient amount that advantages can be realized quickly from it. Machines that can be handled and operated by one man are needed to do these operations. A successful spike driver and spike puller are but a short step from tools which are in common use at the present time and with the proper design, one machine and one man can replace several men with spiking hammers and claw bars. The puller must have a positive and reliable grip and it must develop an initial pull of several thousand pounds to meet all conditions of service.

More Efficient Wrench Needed.

Another device that will yield immediate benefits is some form of a track bolt wrench that will convert a reciprocating motion at the handle of the wrench into a rotary motion at the jaw without the necessity of removing the wrench from the nut. This may possibly be accomplished by means of a ratchet or by some friction device. The tool must be compact and the design must be such that the force applied at the handle is in line with the nut and not offset from it. When first installing bolts, a short-handled wrench can be used to advantage, while for their final tightening and for the purpose of keeping them tight, a long-handled wrench is needed.

Different types of mechanical tampers are already available for tamping ties during tie renewals or surfacing, which will save labor under practically every condition and in many conditions will also save money. Surfacing is usually a large part of the work of a maintenance gang and mechanical tamping equipment requiring four men to operate will do as much work as six men with picks in ordinary stone ballasted track, while the labor saved in tamping about turnouts and crossovers is greater. At an interlocking layout of any size a mechanical tamping plant with permanent connections and taps is economical, and a similar plant is advisable in the vicinity of track troughs. There is also a strong probability that track which has been tamped mechanically is more uniform and permanent than hand-tamped track. Mechanical tampers may also be used to advantage during tie renewals, with proper gang organization.

The work done in lining track is of a kind that is practically confined to that one class of work, and on first thought it seems rather far-fetched to plan to do this by mechanical means. However, the motion necessary to make a throw is simple and in many places the saving of labor would be large enough to give a considerable working margin on the expense of the machine. There are to-day miles of high-speed track where the lining has become more important than the surfacing, and the limiting size of the section gang depends more upon the number of men necessary to line track than on the amount of other work to be done. A mechanical liner under such conditions would not only effect a saving of labor during the actual work of lining, but in some cases would result in a reduction of several men in a gang.

Eliminate Heavy Lifting.

Heavy material can be lifted out and in to advantage by mechanical means when the item of handling material is an important factor in the work being done, as in the case of rail renewals. The heavy-section rails now in increasing use require more than 20 men with tongs to handle a 33-ft. rail. This work quickly fatigues men and the combination of so many men doing heavy work in such a restricted space is a cumbersome and dangerous operation. This work can be done very successfully by mechanical means in a way that reduces the number of men required, lessens the danger of personal injury, eliminates much heavy and fatiguing work and reduces the cost. The total number of rails that can be laid in a given time can also be increased.

There is also the question of cleaning stone ballast by mechanical means. It is doubtful if there is any class of maintenance work where a greater variation in the output per man can be found than here. To clean and return ballast and dispose of the dirt by mechanical means is a big problem, but from preliminary work that has been done, the saving of labor possible is very large, the present cost of cleaning can be greatly reduced and a further saving is possible from the reduction in the requirements for new stone. There is also the possibility of attempting only a portion of the operation by mechanical means.

Of the work that is not directly concerned with the track structure, it is also possible to improve present methods by mechanical means. The present method of mowing with scythes can be bettered by many foremen if they will make a systematic effort to clear and level their right-of-way so that mowing machines with either horse or tractor power can be used. This of course has a limited application, but where there is opportunity a foreman will make surprisingly rapid progress by utilizing odd time for leveling and clearing his right-of-way so that mechanical mowing can be done economically and labor eventually saved.

There is a large opportunity to save labor that is now necessary to keep switches and interlocking apparatus open during snow storms. The method of working many men with brooms and shovels steadily for long hours during a storm to keep switches open can be replaced with one that requires but very few men with snow-melting devices. The heavy and fatiguing labor can be practically done away with by the installation of a simple system of piping and burners which only requires a few men to watch the feeds and to supply fuel to keep the switches free from snow, ice or sleet under the most severe conditions. There is not only a saving of labor, but the work can be done at less expense and with less chance of failure.

Appliances to Conserve Materials.

Besides the opportunity for direct and immediate savings of labor by using machines to replace men, there is an opportunity to save labor by the use of appliances that will increase the life of material and so reduce the labor necessary for renewals, and also by the use of appliances that will tend to eliminate conditions which now require labor to correct. Under this kind of labor-saving devices should be considered rail anchors in places where it may not be considered necessary to anchor the rail to prevent running. The skewing of joint ties can be greatly lessened by the use of rail anchors, and the labor necessary to shift these ties, regage the track and possibly space the adjacent ties can be greatly reduced. The same result is possible by the use of appliances to increase the life of material. An example of this method of sav-

ing labor is the increased life of switch points that are properly housed in the stock rail. By this simple and inexpensive device open-hearth switch points are to-day giving service in excess of 11 months where before the points were housed the life of manganese points had been but 5 to 6 weeks. Much labor formerly necessary for renewing switch points has been saved, as well as the expense of several pairs of high-priced switch points each year.

While present labor conditions continue it is possible that labor-saving devices may be desirable which do not reduce costs. It would seem to be good policy for the present, at least, to consider the function of a labor-saving device to save labor, and within reason, to judge it with this as the primary and important requirement. There is a wide range in methods of solving the problems outlined. Some of them have at the present time been developed to a point where they are a success from a commercial point of view, but there is still opportunity for improvement in these and in others the field is entirely open. The opportunity for success now is greater than at any previous time. It is necessary to get at the fundamental maintenance operations in such a way that the savings and benefits can be realized and taken advantage of immediately, so that it will be possible to maintain a division in a satisfactory manner with fewer men than have formerly been considered necessary. One thing to be kept in mind in this connection is the fact that the design of no part of the track structure has ever been influenced in the slightest degree by the idea of doing track labor by mechanical means.

POWER EQUIPMENT FOR TRACK WORK

By B. M. CHENEY,

General Inspector of Permanent Way and Structures, Chicago, Burlington & Quincy, Chicago, Ill.

There probably never was a time when devices that will save labor were more attractive than at present, both by reason of the extreme scarcity of track labor and the abnormally high rate of pay that results from this shortage. A careful analysis of almost any unit of track work seems to reveal a possibility of labor being saved through the use of some tool or machine that might accomplish the same end. Some such machines and tools have been developed in the last year or so and have given very good results. Others have been tried and found unsatisfactory, in some cases through misconception of their need and in others through lack of proper development. Those devices that have proven successful have been pretty well advertised, and it will therefore be the object of this paper to consider only those that, so far as is known to the writer, have either not been tried or, having been tried, have shown the need of further development.

CAR UNLOADERS. A great deal of the time of section men is consumed in handling material, both along the line and at terminals. Some of this handling at terminals has nothing to do with track work, but is necessary in order to release cars loaded with company or commercial material, and for such work there are a number of labor-saving machines already on the market. Along the line probably the largest item of unloading is that of track ties; a great deal of labor is also required in unloading cinders and gravel from cars other than bottom dump-cars. It would seem, therefore, that some light machine or portable device should be developed for unloading such material.

Some device is needed for the unloading of ties along the track from gondola, box or stock cars which can be operated by three or four men. It should be light enough to be transferred from one car to another quickly by three or four men; be easily installed; be capable of unloading cars at least as rapidly as five or six men, and be safe to operate.

Cinders or other ballast in gondola cars can, of course, be unloaded by a clamshell, thus eliminating nearly all hand labor, but as only two to four cars can be handled at one time, the amount of switching required would diminish the saving very materially. There seems to be a field for some machine that can be moved along over the top of gondolas which, through the medium of a clamshell or shovel, will unload the bulk of the contents of such cars. Such a machine might be operated either by air or steam, and if moved along the top of the cars should be light enough to avoid damage to equipment.

A GASOLINE SERVICE CAR FOR HANDLING TIES AND OTHER LIGHT MATERIAL. Assuming that ties are not distributed exactly where they are to be used, but will have to be moved distances ranging from 100 to 1,000 ft. or more, there is a field for a light machine capable of picking up six or eight ties at one time to load them onto a push car or move them along the track and unload them where they are to be used. In unloading ties from cars along an embankment some of them are apt to roll down the fill and a great deal of time and labor is expended in getting them back up to the track. This could be done very quickly and cheaply by such a service car. Crossing planks, rails and other track materials could also be handled. Probably the greatest efficiency could be obtained from such a car by sending it on a continuous work trip over a division picking up, placing and distributing material.

A TIE RENEWER. The item of tie renewals is one of the heaviest of maintenance expense. At the present rates of labor it costs from 20 to 30 cents to renew a tie, and as the average renewals run from 200 to 300 per mile, any considerable saving per tie is bound to make a considerable saving per mile. It would seem that a device could be contrived that would pull out the old tie and pull the new one into place., perhaps with the same movement. Such a machine should, if possible, be light enough to be removed from track by six or eight men from the gang of tampers following. Track conditions vary to such an extent that it would be useless to try to describe in detail the requirements of such a machine. It should be developed under the direction of a competent roadmaster or track foreman.

A BOLT TIGHTENER. Turning a nut onto a bolt with an ordinary track wrench is one of the slowest and most cumbersome processes of track work. Each movement of the wrench means only a quarter turn of the nut, and from the first turn to tightness it has been noted that from 25 to 35 such movements are required. A power machine that will do this work, even though the final turn or two be left to be done by hand, would effect considerable economy. It has been found that it requires about 30 min. for one man to turn the nuts onto a 4-hole track joint, which, at the present rates of pay, would amount to from 10 to 15 cents per joint. If a machine were contrived that would do the bulk of this tightening the cost would probably be reduced 50 per cent or more. Possibly such a machine could be developed so that it would complete the tightening, but if this were possible it would probably be necessary to use a pressure gage in order to be sure that bolts would not be stretched beyond their elastic limit.

A NUTLESS BOLT. Even better than the above would be a bolt that would require no nut at all. One or two

such devices are already being exploited but, so far as is known to the writer, they have not been tried out practically. However, it seems possible that a device of this kind might be developed which would automatically take up any mechanical wear by spring pressure or otherwise and keep the joint trussed up to the rail. Such a device would effect a considerable saving, both in the installation and in the maintenance of joints.

A SPIKE DRIVER. The success of the tie-tamping machine makes it seem probable that it is only a step further to a spike-driving machine that will not only reduce the cost of spiking, but will probably do the work better and more uniformly.

A WEED MOWER. Several weed-mowing machines are already on the market, operated both by motor car and by hand car. These machines are limited to about 12 ft. on each side of the center line of the track. The economy effected by their use is such as to make it appear very desirable that a machine be developed for mowing the weeds outside this 12-ft. strip. It would seem possible that some machine such as those used for mowing parks and golf links might be used, with the type of blade on the plan of the regular farm mower and strong enough to handle large weeds and light brush, instead of being adapted to mowing short grass.

A TIE-ADZER. One of the most expensive items in connection with rail relaying is that of adzing ties, not so much in the actual amount of labor required in adzing as from the standpoint of tie destruction. Unless the men put on this work are watched closely they mutilate the ties, adz ties that should not be adzed at all, and usually leave an uneven bearing for the rail or tie-plate. To overcome this difficulty as far as possible a tie-marker has been developed, consisting of twin circular saws run by gasoline power which mark the ties on each side of the rail to a depth level with the base of the rail. It is an easy matter then to instruct the men that they shall adz to the depth of these marks, and it is found that much better results are obtained than where this machine is not used. However, it seems as though it should be possible to design a machine that would complete the adzing process in track, and if this can be done it will effect a large saving in labor and at the same time effect the maximum conservation of ties.

A RAIL-GRINDER. For some time the street car companies have been making good use of rail-grinders for smoothing off battered joints and burnt spots in the rail. These machines have not yet been applied successfully on steam roads, although the field is much greater than that of electric lines. A large per cent of the rail renewed each year is taken out on account of battered ends. Taken in its early stages, these battered ends might be smoothed out by such a machine, thus adding years to the life of the rail. New rail varies in height and the difference is no doubt the primary cause of many battered joints. These might be "leveled" off as soon as laid and before the top of the rail becomes case-hardened. Wheel-burnt rails near stations and signals might also be resurfaced, as is done by the street car companies, thus avoiding the relaying of considerable stretches of track and at the same time effecting a saving in rail.

SNOW REMOVAL. The fight that is now being waged with snow reveals a lack of satisfactory machinery for its removal. Snow plows and spreaders serve to clear one or two tracks, but where there are more than two, and particularly in terminal yards, where much of the snow must be loaded, some new device is needed. After the tracks are flanged so that engines can operate over them there should be a machine for loading the snow onto cars. Such a machine might be along the lines of the grading machine used by contractors in loading earth into wagons. The loading machine would probably be operated on the track next adjacent to the work train being loaded. Such a machine would no doubt accomplish as much in a day as would be done by a large gang of men in a week. In order to make this a machine that can be used the year round, it should be built strong enough to be used as a ditcher. A ditcher of this type would give better results in most cuts than the shovel type that is now used.

In normal times a labor-saving device must accomplish a reduction in unit costs to prove attractive, but labor conditions are now such that even though no reduction in cost is effected, a device that will do the work with less men will find a ready market.

LABOR-SAVING EQUIPMENT FOR BRIDGE AND BUILDING MAINTENANCE WORK

BY GEO. W. REAR,
General Bridge Inspector, Southern Pacific, San Francisco, Cal.

A generation or so ago it was claimed that the main requisites of a bridge and building man were a weak head and a strong back. Admitting, or at least not denying, the first qualification, we must acknowledge that the second requirement is still in force on many roads. Labor-saving devices are usually available for large construction jobs, but for the general run of maintenance work man power is still used to do most of the lifting, lugging, pulling and hauling for which horses and machinery are better adapted. Most railroads are equipped with pile drivers, cranes, etc., for heavy work, but these require work trains or specially constructed side tracks and are not suitable for ordinary repair work.

As a rule, gangs are furnished with jacks, tackle, handwinches, dollies, etc., to make man power effective, but the prime mover is still the old "Armstrong" or "Muscleene" motor.

The principal reasons why labor-saving equipment has not been more extensively adopted for this kind of work are the lack of suitable machinery and the fact that it may not be figured to pay in dollars and cents. In most cases, perhaps, it will not pay to set up ordinary machinery to do the odds and ends of maintenance work, but for several years there has been a movement to make the bridge and building man something more than a beast of burden, and the present scarcity of men due to the war, only adds emphasis to the need. This is, therefore, a good time to study the subject to see in what way the adoption or development of machinery can save human energy at a profit, or at least with little loss of money.

TRANSPORTATION. Naturally the first consideration should be given to means of transportation, not only of men, but of material. The hand car is a back-breaker, but its companion, the push car, is a close second. Old employees can look back over endless miles of push-car work, up and down grade, conveying material from some siding to work on the road, for a job has to be of considerable size to warrant a work train or to hold the way freight for loading and unloading supplies. The motor car is changing this, but the proper car should not only carry the men, but have capacity to pull loaded push cars at moderate speed. One or two men with a good motor car can handle more material than 20 men with push cars, especially if the distance is great. Gangs can also cover a greater radius from headquarters, instances being known of gangs conveying material for small jobs as

much as 40 miles, placing it and returning the same day. This, in many cases, saves moving a boarding outfit from place to place for small jobs.

It is recognized that motor cars are still in a state of development and that there are many reasons why a perfect car cannot be constructed, the chief reason being that the weight must be inside the limits men can handle on and off the track. However, there have been great improvements in recent years, not all of which have been along proper lines. The proper bridge and building motor car should have a free-running engine, with at least two speeds, not too fast (20 miles an hour is fast enough), and it should be able to pull a good load at moderate speed. Many accidents have occurred in starting cars that have to be pushed to start them, and such cars are not suitable for pulling other cars. The car itself should be light, but sturdy, and the engine should be simple and reliable. As soon as possible motor cars should be standardized so as to lessen the number of repair parts to be carried. One large western road carries over $12,000 worth of parts for the cars it has in use.

Framing Machinery. It is doubtful if any use can be made of power saws for framing timber for the ordinary bridge repair job, for if cross-cut saws are kept in good condition, timber can be cut to length about as easy as to carry it to a power saw. The amount of framing in modern structures has been reduced so much that it now forms a very small part of the work. Pneumatic tools are great labor savers for boring holes and driving spikes and drift bolts and use should be made of them wherever power is available.

Hoisting Machinery. The real hard work is the lifting and pulling and for this the hoisting engine is best. We have always thought of the hoisting engine as a steam machine, but in this age of gasoline the internal combustion engine makes a very good hoist for light work, as it is so much lighter and easier to handle that it can be used on jobs where it would not pay to set up a steam machine. A unit of about 10-hp. is most suitable and will weigh somewhere around a ton. It can be handled readily on a push car and, if used with a light push-car derrick, will perform the same kind of work as a locomotive crane. Within its capacity it is a great labor saver. The development of such a machine offers a good field for the inventive manufacturer. It should be light enough to be removed from the track with the aid of a portable turntable or by the use of cross trucks and temporary rails. Its capacity and radius of action will, of course, be limited.

Pumping Machinery. The internal combustion engine is well adapted to pumping out cofferdams, etc., and it can be used with centrifugal and belted pumps. A small engine connected to a diaphragm pump makes a very compact and efficient unit, where the amount of water to be pumped does not exceed about 3,000 gal. per hour.

Concrete Machinery. Mixing concrete now forms a considerable part of the work of every bridge gang and much concrete is still mixed by hand. This is extremely hard work and has done more than any other one thing to drive good men into other employment. The reason machine mixers have not been adopted more extensively is that they have been cumbersome to set up for small jobs. Smaller sizes mounted on trucks are now on the market and there is no longer excuse for hand mixing.

The proper mixer for small jobs should be of a size to take what is known as a one-sack mix, that is, one sack of cement and the proper amount of loose materials to make the desired mixture. Such a mixer should be operated by a small gasoline engine and be mounted on a truck so that it can be set up in a few minutes. Smaller sizes make it necessary to empty the sacks of cement and use some other unit of measure with loss of efficiency.

Excavating Machinery. For small jobs there is probably no opportunity to develop power apparatus except to use an engine to hoist buckets of material, but the ingenious foreman can get surprising results with a hoisting engine and a scraper.

Machinery for Metal Bridge Work. The use of pneumatic tools for boring, cutting and riveting has become so universal that no one would now think of doing such work by hand, and it is doubtful if there is a field for the development of such tools. Riveting hammers and boring machines are in general use, but more extensive use can be made of the "rivet buster," which is a great labor saver for cutting out rivets.

There is, however, a field for the development of the air compressor plant. What is needed is a small, compact unit, probably mounted on a push car, that can be set up quickly for small jobs. It should have a capacity of at least 50 cu. ft. per min. at 100 lb. pressure and the engine should be of a light, high-speed internal-combustion type. Something like the compressing plants used with tie tampers would be suitable, but they need not be self-propelling.

For cutting metal in the field the oxy-acetylene torch is a great labor and time saver and such equipment should be among the tools of every steel bridge gang. There is practically no need for the welding tools that are usually supplied with these outfits. In order to keep edged tools in good order, grindstones and emery wheels are necessary and they should be power-operated.

It may be possible to develop machinery for bridge gangs so that one engine can be used to operate a hoist, a concrete mixer, an air compressor or grinding machinery.

Machinery for Buildings. Power-operated cut-off and rip saws are great labor savers on building work and a portable outfit of this kind should be part of the equipment of every gang engaged in work of such size as to make it pay. A gasoline hoist is also valuable for hoisting, even on one-story buildings.

Machinery for Painting. In the past, painting machines were called sprayers and the name in general was very appropriate. They were very wasteful of paint and should not be used for anything except whitewash and similar coatings. Modern air brushes are better controlled and much more economical. Either of the styles are great labor savers. Sand-blasting outfits should be provided where considered advisable.

Closer Union of Pennsylvania System.—The Pennsylvania Railroad Company took over the direct operation of the Pennsylvania Lines West of Pittsburgh previously operated by the Pennsylvania Company on January 1, 1918, and those portions of the system will in future be known as the Pennsylvania Railroad Company, Western Lines. These lines include what have heretofore been designated as the Northwest System and the Central System and comprise the direct main line and branches between Pittsburgh and Chicago. The Pittsburgh, Cincinnati, Chicago & St. Louis, embracing the Southwest System, will continue to be operated under its own organization. Headquarters for the Western Lines will remain at Pittsburgh, and with the old officers in charge.

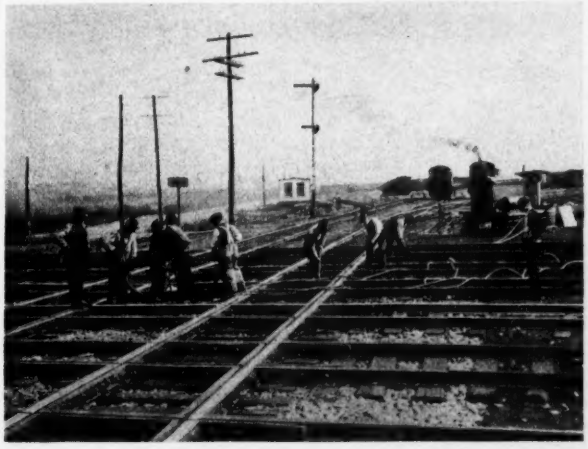
REPLACING MEN WITH MECHANICAL EQUIPMENT

A Series of Descriptions of the Use of New or Standard Devices to Handle Work With Less Labor

ON THE PAGES immediately following appear several articles describing the use of mechanical equipment to affect a savings in labor on railway work. In some instances new devices have been developed to accomplish this result, while in others standard equipment has been employed. These articles should suggest other expedients which can be adopted to enable work to be completed with the limited number of men available.

COMPRESSED AIR IN MAINTENANCE WORK

In the present acute labor shortage with men practically unobtainable at reasonable rates in sufficient numbers to carry on even the most urgent work, com-



TAMPING A SET OF CROSSINGS

pressed air is of particular advantage to the maintenance of way department because of its adaptability to various kinds of maintenance work. It is the purpose of this article to point out some of the important uses to which air has been put in maintenance work as a means of saving labor.

PNEUMATIC TIE TAMPERS

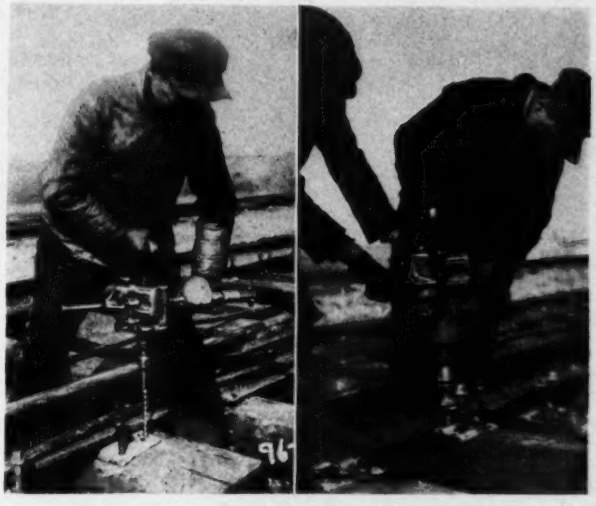
The most common use of compressed air in maintenance work is in the operation of pneumatic tie tampers. The tamping tools may be operated either by utilizing existing air lines, as in the case of the Pennsylvania, where a permanent installation of air for use in connection with pneumatic switch and signal systems and other purposes is available in the mainline territory between New York and Pittsburgh, or in connection with portable gasolene-driven air compressors provided for the purpose.

Many of the large eastern roads, including the Lackawanna and the Lehigh Valley, are using tamping outfits operated in connection with portable compressors. The first outfits were installed on the Lackawanna in the summer of 1916 when five outfits of the four-tool type were placed in service on the west end of the Buffalo division as a test installation. These outfits were placed on alternating sections to test out their efficiency as compared with hand tamping on the adjoining sections, and as the result of this test 25 additional outfits were purchased and placed in service in June, 1917.

With these outfits in addition to the first five, the 217 miles of main line between Halsted, Pa., and Buffalo, N. Y., was completely equipped, leaving the 179 miles of main line between Hoboken, N. J., and Halsted unequipped. Thus the situation was favorable to a study of the efficiency of the tamper as a means of saving labor when working under the peculiar conditions obtaining in 1917.

In 1917 the gangs were short-handed and the labor employed was below the usual standards, causing a decline in gang efficiency. Working under these conditions, it was found that machine work was done at a less cost and was better done than the hand tamping. This was due to the fact that an efficient foreman was able to control the machine work to a greater extent than the hand work. With the machine a good job is a matter of position and time of tamping, which the foreman could control, thus in a measure overcoming the inefficiency of the labor, while with hand tamping it is a matter of strength and willingness as well, both of which are beyond the control of the foreman. The outfits were found to be especially valuable for gangs which were short handed because of the greater output of work units per man. With six men to the section as a minimum a foreman was able to keep his track in good line and surface and, because of the superior work of the tamper, once the track was in shape it held better.

The tampers were found particularly efficient in complicated track work as in yards and at interlocking plants where hand tamping is practically impossible. They were also found to be economical in resurfacing, as loose



BORING HOLES FOR AND DRIVING SCREW SPIKES

ties may be tamped without digging out the ballast when the work is done with the machines. With hand tamping this digging out is necessary to tamp the ties properly. On the strength of the results obtained early in 1917, the Lackawanna purchased 25 additional outfits. These have been delivered and 7 more are now under construc-

tion, making a total of 62 outfits in all. With these placed in service the entire main line between Hoboken and Buffalo will be equipped.

OTHER USES OF THE COMPRESSOR

In addition to the operation of the tamping tools the air compressors may be utilized in various ways. By the substitution of a suitable bit or chisel for the tamping bar the outfit may be used for cutting pavements and concrete foundations away from the rails in city streets; on railways with track pans on the line the cutting tools may be used in combating ice conditions. By the substitution of other tools for the tamping tools, the compressor may be utilized in cleaning rust from steel; as a sand blast, for painting steel or other structures, and for other purposes, some of which are described below.

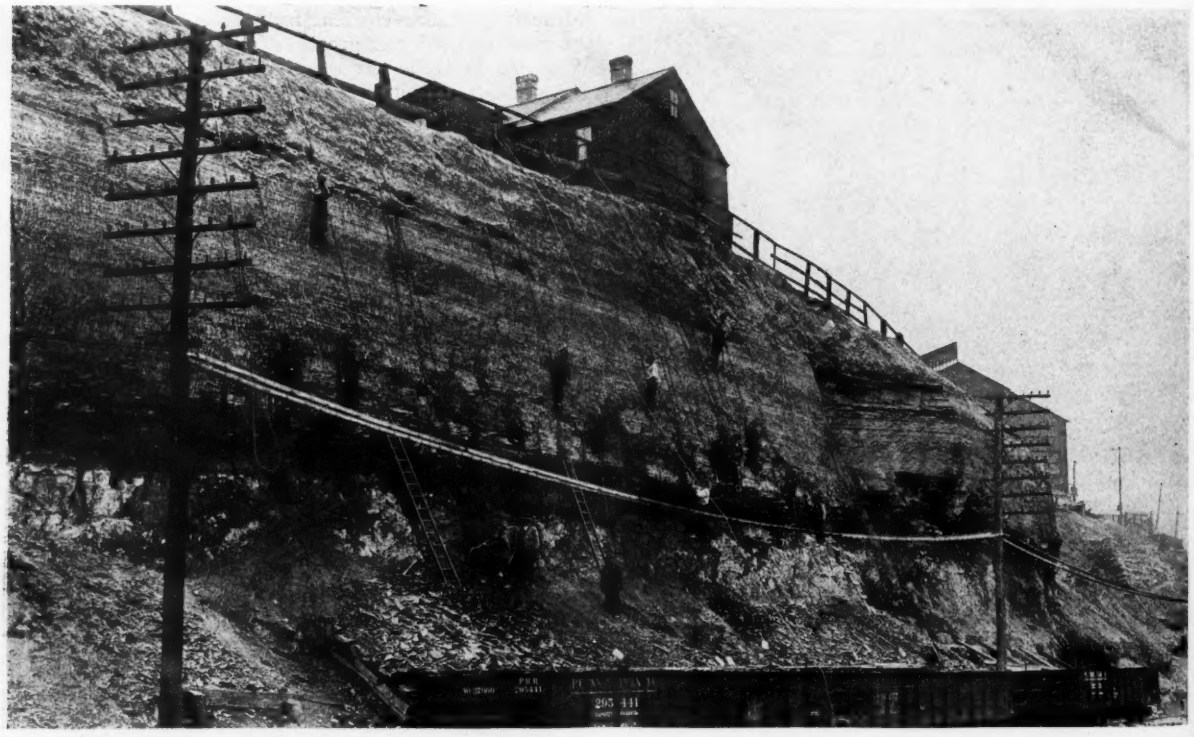
The Lehigh Valley utilizes the compressors the year around. In winter they are employed on the line to supply air to boilermakers' tools, thus releasing locomotives generally used for this purpose. They are also used by the bridge and building department in sawing and boring bridge and other timbers and it is proposed to utilize them for operating saws for cutting timbers. Compressors have also been utilized by the Lehigh Valley to supply air to train lines in yards where the regular equipment was one of order or the supply was insufficient. Here again they replaced locomotives.

In placing the rail on the 26 miles of line of the New York Connecting Railway, the compressors were used in connection with Ingersoll-Rand Little David No. 11 S. E. reversible drills in placing screw spikes. A description of the method of placing the spikes and the apparatus used was published in the *Railway Maintenance Engineer* for September, 1917. Exclusive of the overhead expense and the depreciation the cost per spike placed by this method averaged $0.008.

THE PENNSYLVANIA UTILIZES EXISTING AIR LINE IN REMOVING ROCK

The Pennsylvania Railroad recently employed air in a novel way for widening a rock cut on its line between East Liberty, Pa., and Pittsburgh. The rock removed is known as Pittsburgh shale and, while soft and having decided cleavages, is hard enough to make its removal by hand picks difficult. The local restrictions prevented the use of explosives and as the work was of considerable magnitude, being 400 ft. long with a thickness ranging from 10 to 25 ft., it was decided to utilize tamping tools fitted with bars with pick points in place of the tamping bars to remove the rock.

Rope slings to support the men and tools were attached to the fence at the top of the cut and, together with an air hose, were strung along the face of the cut. The work commenced at the top of the wall and progressed downward in shelves, each cut being made to the full depth back to the permanent face. The operator picked downward through the rock for a distance of about 8 in. and then drove the pick into the horizontal seam, breaking the rock off in layers about 6 in. thick.



REMOVING A ROCK FACE IN A CUT

Owing to its brittle nature the rock broke off in comparatively small pieces, which became further broken up in the downward course into gondola cars which were placed alongside the work. Plank aprons were provided to enable the spoil to be loaded into the cars with the least effort. The method of placing the slings and the loading of the material are shown in the photograph. The air supply for the tools was obtained from the supply line which is used in connection with the signal system.

RECENT DEVELOPMENTS IN AIR TOOLS

Two air-operated tools which are applicable to maintenance work have recently been perfected by the Inger-

soll-Rand Company, New York, and are now in use on several of the eastern roads. The tools are a spike-driving hammer for seating cut spikes and a pneumatic rail drill, which is used for drilling rails for joints and for bonding.

A PNEUMATIC SPIKE DRIVER

The pneumatic spike driver is larger than the riveting hammers familiar to railway men. The complete machine is 25 in. long and weighs slightly more than 60 lb. It strikes a slow, hard blow under the positive control of a trigger located on the inside of the T handle and when starting the spikes it is possible to throttle the hammer blow to a light tap. The piston of the tool transmits the driving force through an interposed hammer block, which is cupped out to accommodate the head of the spike. The hammer is of bolted construction and can be taken apart for cleaning without the use of a vise or tools hoter than a wrench. The hammers are in use on several eastern roads. From a time-saving point of view it has been found most efficient to start the spikes by hand and finish the driving by the machine. It takes approximately five seconds to drive home a spike. One man with a spike driver can follow three men starting spikes and drive home all they can set up.

The pneumatic drill, which is known as the No. 9 "Little David," is equipped with a three-cylinder motor, giving it a constant power impulse. It weighs 37 lb. and operates at a speed of 140 r.p.m. The spindle socket accommodates No. 4 Morse taper shanks. As shown in the photograph, a lever type "Old Man" has been developed for use in attaching the drilling machine to the rail. Its quick clamping action minimizes the time required for a set up and the constant pressure drill feed is a further advantage. Observations for actual drilling speed show an average of 45 sec. required for an 80-lb. rail and 1 min. 20 sec. for a 120-lb. rail. The construction of the drill is simple and the breakage possibilities are less.

RAIL DRILL OPERATED BY AIR

A SWITCH POINT STRAIGHTENER

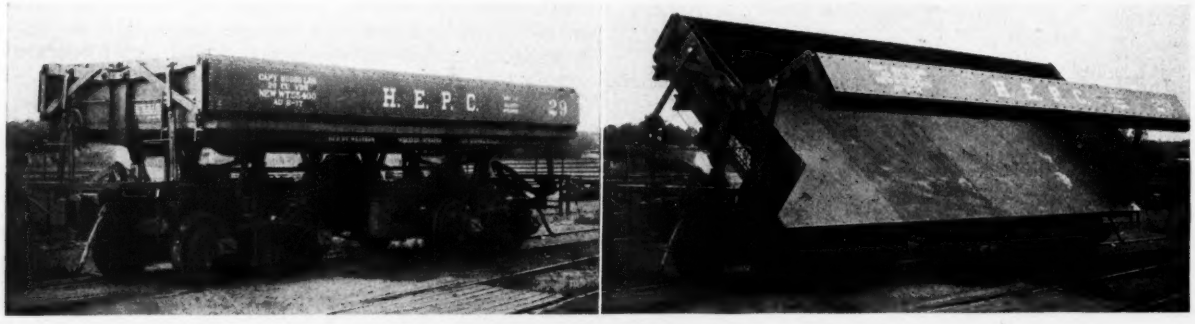
The accompanying photograph illustrates the application of a simple device for straightening switch points. It is true that run-through switches are restored regularly by the use of a track jack, but this is an awkward job, because of the difficulty of getting a good heel for the jack. The device illustrated accomplishes this in a way not possible with the ordinary track jack, in that a yoke is provided to go over the two rails and secure a bearing on the web of the stock rail.

The device is simple. There are only three main parts in addition to a lifting ring and two bolts. The pressure is applied to the switch rail by a rack-and-pinion operated plunger which is forked at the end to engage the edge of the rail base. The upper side of the pinion has the form of a socket to receive an ordinary lining bar or other strong lever with which to apply the pressure. The larger bolt shown in the picture is the pivot for the pinion while the smaller one serves as a stop to keep the plunger from sliding out of its guides whenever the device is being carried about. One further item of the equipment is a small metal wedge shown in the picture which is placed between the two rails to provide the necessary fulcrum at the point of bend. This device was recently placed on the market by the Madden Company, Chicago, and has been used for a short time on the Chicago & Alton and on several other roads.

STRAIGHTENING A BENT SWITCH POINT

AIR DUMP CARS IN DITCHER SERVICE

One of the most effective applications for standard-gage air-operated dump cars is in ditcher service, where the necessary occupation of the main line demands equipment that provides for the quick or almost instantaneous unloading of the cars as well as their rapid loading. The arrangement under which these cars are used, involving one or more combinations of dump cars on either side of a flat car on which is mounted an American ditcher is familiar to most railway men in maintenance work. The Western air dump cars, manufactured by the Western Wheeled Scraper Company of Aurora, Ill., have been used extensively in this service and this company has recently perfected a new type of car shown in the illustration below which is designed for heavy service, but especially for ditching work.

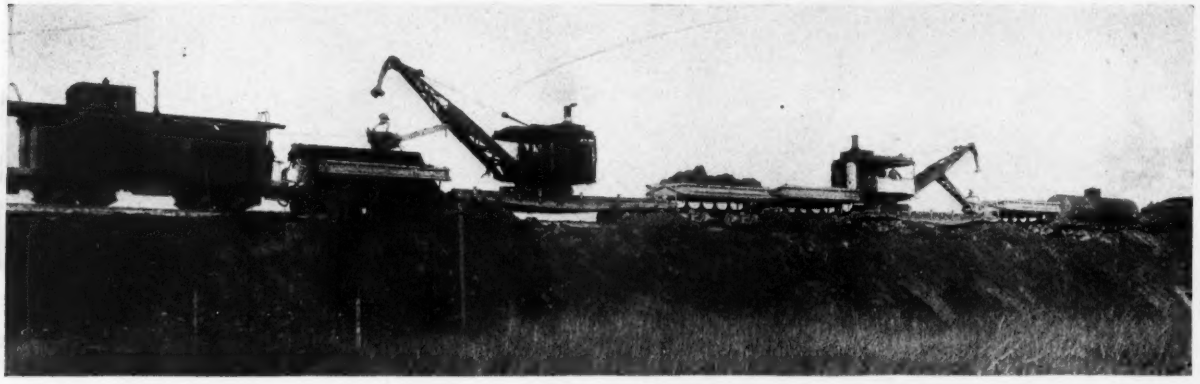


TWO VIEWS OF THE NEW DUMP CAR

This is known as the Western automatic compression lock car. The dumping and righting of the cars is accomplished by the use of two short-stroke vertical cylinders placed on either side of the car, the piston rods of these cylinders engaging with the underside of the bed through a hinged connection, called the push rod extension. The same general design of hinges and door operating mechanism is retained as has been used on Western cars for the last 20 years.

The features which are individual to this car are the means of unlocking, locking and controlling the position of the bed without the use of side chains or any fixed connection between the bed and underframe. It was considered advisable to support the bed of the car in such a manner as to transmit the stresses due to dropping the heavy dipper loads, directly to the truck springs. This has been accomplished by using a strut or post, hinged at the bottom end to the body bolster. To lock the car in the carrying position a brace has been pivoted at the upper end of the strut, the lower end engaging with a cam fastened to a rock shaft, which in turn is operated by the movement of the piston in the cylinder.

Considerable information has been accumulated concerning the results secured with dump cars in ditcher service and it is believed that the statement of a few of these examples citing the circumstances under which the work was conducted and the economies secured will be found of interest. One of the divisions of the Mobile & Ohio was operating an American ditcher with flat cars and plow unloader, and because this method proved rather cumbersome and expensive the roadmaster began to experiment with two old coal cars, which he converted into crude side-dumps. After carefully testing the makeshift device, he found that he was effecting a considerable saving, having reduced the cost of the work to $540 a month. However, he found that he could borrow two 12-yd. dump cars from a neighboring contractor, and with these he was able to reduce his monthly cost from $540 to $300 and also enable his crew to do from 20 to 30 per cent more work. In other words, for 44 per cent less money he was doing 25 per cent more work. The saving compared with the flat car-unloading plow operation was, of course, much greater.



A TRAIN IN DITCHING SERVICE

The following is the cost record for ditching on the Georgia, Florida & Alabama during a three months' period, using Western 20-yd. air dump cars with an American ditcher. In 14 weeks this equipment completed 57,221 lin. ft. of ditch, excavating 29,442 cu. yd. of dirt at a total cost of $4,134, or an average cost of 14 cents per cu. yd. In general the ditcher worked six days per week, but five days of the total time were spent in borrow pit work and a total of 31½ hr. was lost on ac-

count of breakdowns. The delay suffered in clearing regular trains varied from 4 to 16½ hr. per week.

The Illinois Central is disposing of rubbish in its Chicago passenger terminal yards in 30-yd. air dump cars instead of storing the material in coal cars until it could be hauled away and disposed of by shovelers. The loaded cars are collected into a train at some convenient time, hauled down to the southern part of the city and dumped upon a low piece of ground. The plan has worked so well that the City of Chicago, unable to get men to take care of the rubbish in the downtown district, turned the work over to the railroad company under contract, to be handled in the same way.

NEW USE FOR A DRAG-LINE BUCKET

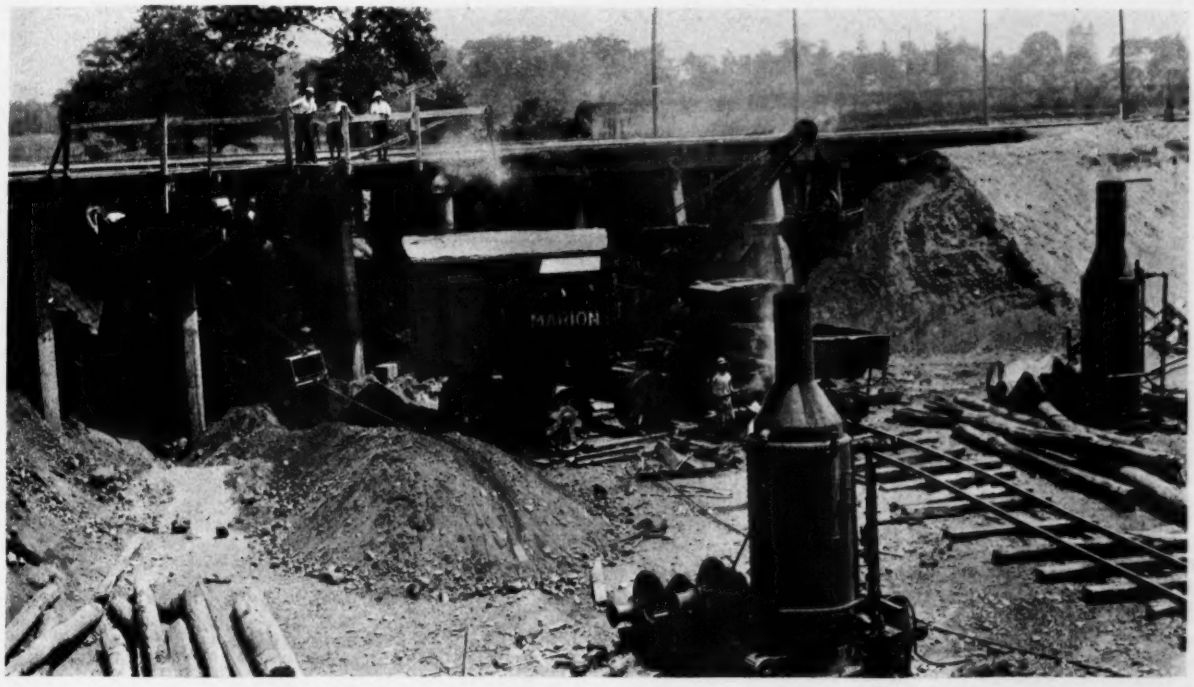
By A. B. Cohen,
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

Where it becomes necessary to proceed with railroad or other construction work not directly related to our war preparations, any development that conserves man power is particularly commendable at this time in the face of an irremediable shortage of labor. This shortage has done far more to impede the progress of railroad improvements than the unparalleled costs of materials, together with the delays incident to their delivery.

The accompanying photographs illustrate a simple arrangement of the drag-line method of excavation, excellent in its adaptation, since the conservation of labor is unusually efficacious, for the extra reason that the work is being done in a select residential section, far removed from a labor center. The drag line is here used in making a cut under railroad tracks for the construction of an under-crossing. The work is being done under contract for the Delaware, Lackawanna & Western in the separation of grades at the Punch Bowl crossing near Morristown, N. J. A reinforced concrete bridge of the unit pre-cast slab construction is planned to carry two tracks of the railroad and two alongside belonging to the Morris railroad, a traction company sharing in the improvement.

The scheme consists in the coupling of a drag bucket to a three-drum hoisting crane of 15 hp. One of the three lines of cable pulls the bucket forward, another, attached to the top of the bucket, controls the dumping or overturning, while the third line, fastened to the back and anchored to a dead man, returns the bucket to the starting point. The bucket is made of ¾-in. plate and is 3 ft. 6 in. in length, 2 ft. 2 in. in width and 2 ft. 6 in. in depth, weighing about 800 lb. It was built of scrapped pieces by the contractor, thus precluding the long delay contingent with all orders of equipment. The steam shovel and the work train seen in the foreground of the illustration were used primarily for excavating 17,000 cu. yd. of earth necessary to depress Punch Bowl road in the approaches to the under-crossing and for the depression of another highway parallel with and adjacent to the railroad tracks.

The work started with the driving of a pile trestle under traffic, and contrary to expectations a compact gravel, containing large boulders, was found under the tracks. This rendered impossible the driving of the piles to a sufficient depth to complete the excavation in a continuous operation. It was therefore necessary to replace the piles during the excavation with 12 in. by 12 in. timbers, as shown in the photograph.



Excavating with a Hoisting Engine and a Drag-Line Bucket

To start the drag bucket, a small core or heading just large enough to permit its passage was excavated by hand directly underneath the stringers of the trestle. As the bucket worked its way downward, a trench was formed which, owing to the compactness of the soil, had almost vertical sides, and these had to be caved in by hand intermittently to feed the bucket. This development required two more men than would have been needed if sand had been encountered throughout. As it was, three laborers and an engineer performed the work

in two weeks, dragging 1,600 cu. yds. from underneath the trestle. This material was removed by the steam shovel and work-train operators, after they had completed the depression of the highways, and was carted an appreciable distance to the dumping ground.

The work is being done by F. M. Talbot Co., contractors, of New York City. The improvement is being made under the direction of G. J. Ray, chief engineer of the D. L. & W., and is supervised by M. D. Doughty, division engineer.

A CENTER SEAT INSPECTION CAR

The car in the accompanying photograph has the general appearance of a section gang motor car, but is in reality a light inspection car following the lines of the usual section car, that is, the seat is placed symetrically in the center. The idea of this arrangement came about through a desire to obtain the greater stability to be secured through a more nearly uniform distribution of the load on all four wheels as compared to that obtained with the usual form of inspection car having the seat along one side. The practical fulfillment of this idea implies a lightness in structural design that will enable one man to romove the car from the track and replace it without undue effort.

A CONVENIENT SEATING ARRANGEMENT

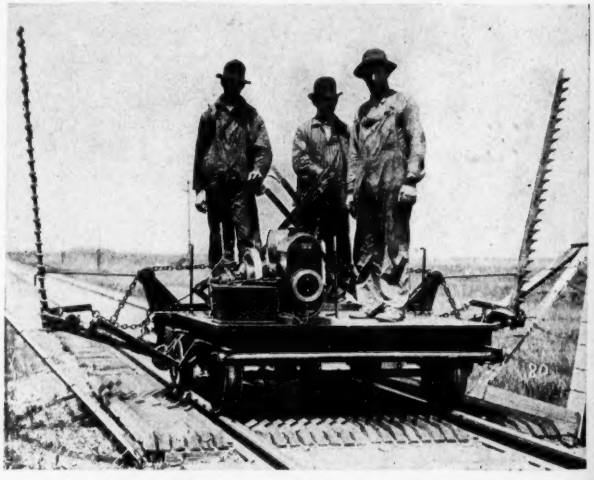
Cars of this type have been used during the last year on the Chicago, Burlington & Quincy, the Chicago, Rock Island & Pacific and the New York Central and are said to have gained considerable favor with the men who use them, because of the feeling of confidence inspired by the stable arrangement and the greater comfort afforded by the adopted distribution of the seating and floor space.

The weight of only 440 lb. is made possible through the use of an all-wood frame, reinforced with iron where necessary. The engine is a four-horsepower, two-cycle, air-cooled engine, the two-cycle feature permitting of operation in either direction with equal facility. The engine is geared to one of the axles, the wheels on the other axle being loose, thereby making for greater ease in handling the car on and off the track. If desired the car can be obtained equipped with a double tank to permit the use of either kerosene or gasolene as fuel, operation with kerosene being accomplished by starting with gasolene. The car is known as the "Safety-first Class E-6" inspection car, manufactured by Mudge & Co., Chicago.

SAVING LABOR IN WEED MOWING

The use of a railway motor car equipped with mowing knives to cut a swatch 6 ft. wide on each side of the track has become current knowledge among railway maintenance officers, since the experimental use of this equipment on a division of the Chicago, Milwaukee & St. Paul during the summer of 1915, and the practicability of cutting weeds and grass by this means has become generally appreciated with the more extended use of the equipment on various railways throughout the United States and Canada. These mowers are now in service on the Burlington, the St. Paul, the North Western, the Spokane, Portland & Seattle, the Illinois Central, the Canadian Northern and the Philippine Islands Railroad. To put these current ideas in a more definite form, the Fairmont Gas Engine and Railway Motor Car Company, Fairmont, Minn., the manufacturers of this mowing machine, have compiled information received from a large number of roadmasters who have operated the mowers during the past season, and this information has been made available for presentation here.

One of the photographs shows a machine with its crew of three men. It is equipped with two mowing knives such as are provided on the mowing machines used by farmers. These knives are connected by gearing to a gas engine, which is also geared to one of the car axles to propel the car along the tracks. The car travels at a rate of three miles per hour, while mowing, its operation being controlled by one of the men while the other two alter the positions of the two mowing knives to suit the varying contour of the ground or to lift the knives clear of obstructions by means of four levers. When the sickle bars are raised and out of gear, as shown in the illustration, the engine may be thrown into a high speed gear so that the car may be operated at a rate of 15 m. p. h. The character of the work done by the machine is illustrated in the other photograph, which shows the two uniform swaths made by a machine which has just passed.



KNIVES RAISED READY TO MOVE

After a study of the information gathered from the various roadmasters using the machine it was concluded that more representative results would be obtained by including only the information received from roads that

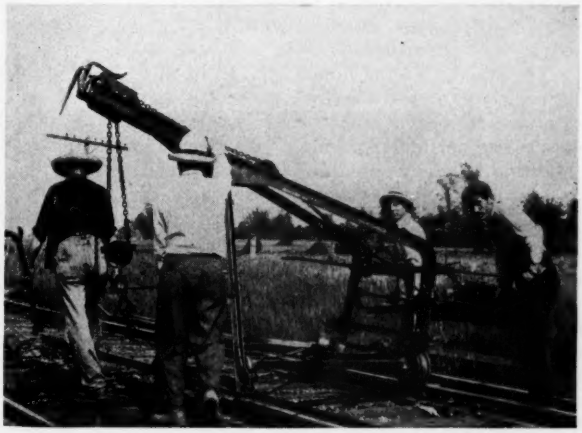
received their machines in time to do a full season's work. With this adjustment the results were as follows: The approximate number of miles mowed by each machine (both sides of the track) during the season was 350, or an average of about 15 miles per day. The average number of miles mowed per gallon of fuel was five, the fuel cost for the season averaged $14 per machine and the cost of lubricating oil $5.67. The average labor cost for the three men operating the machine was $6.90 per day. Better results than this were secured in individ-

THE MOWERS CUT NEAT SWATHS

ual cases. One machine cut an average of 18 miles of track per day at a cost for fuel and labor of $1.59 per mile. The machines are used successfully through heavy marsh grass, sunflowers and other heavy stalk weeds.

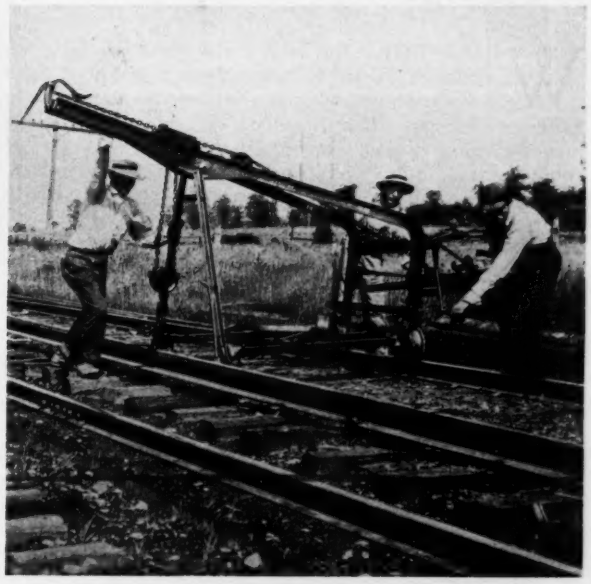
SERVICE RESULTS WITH A RAIL LAYER

No branch of railway maintenance of way work offers a more fertile field for labor-saving than the renewal of rails. With the ever increasing weight of rail a larger number of tong men are required to the rail length, who serve no other purpose than that of human hoisting engines. They should be replaced by mechan-



MOVING AHEAD

ical equipment not alone because of the crying need of saving man power wherever possible, but also because with the large number of men required to handle heavy rail it has become increasingly difficult to work the men efficiently and the danger of injuries has likewise increased. The use of the Madden track layer as a substitute for this manual handling of the rails has extended over several years and the general characteristics of this device and mode of operation are of more or less common knowledge. Intended primarily as a labor-saver, its use in rail renewals has been advocated on the ground of the saving in men to be accomplished. At the same time various records in rapid rail laying have been secured which indicate that the machine acts in no way as a limitation on the rate of rail laying. In other words, having introduced the rail-laying device to replace the tong men the speed is dependent upon the number of men employed to perform the other operations of the work and the manner in which they are organized. The following are excerpts from a railway engineer's report based on a test of the rail layer in renewing 100-lb. rail with new rail weighing considerably more than 100 lb.



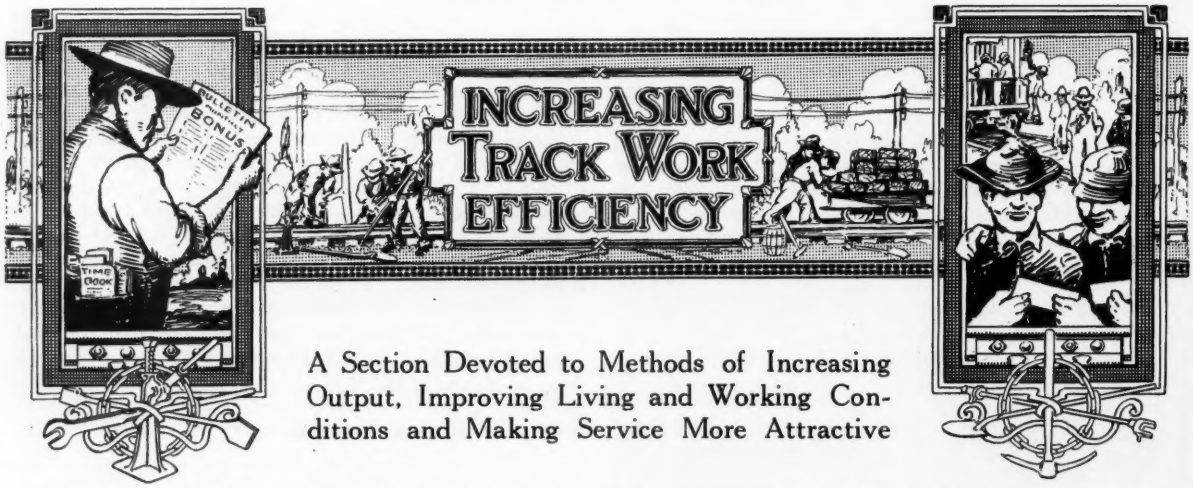
SWINGING THE RAIL INTO PLACE

"A test was made in April, 1917, renewing 100-lb. with the new heavy rail. The 100-lb. rail was thrown out with bars, the machine following this gang putting the heavy rail in place. To handle this with tongs required from 20 to 24 men, and it is hard work for these men.

The following conclusions were given: "There is a saving in labor cost, which may be taken as $50 a mile for the heavy rail and $40 a mile for 100-lb. rail. Rail laying may be handled with a smaller gang. The work may be done faster. In laying rail with the machine, the expansion is more uniform, as the rail is put in place more easily. On tracks at 13 ft. centers, the machine does not foul the adjacent track.

"Rail should be unloaded to final position in track on outside of both rails. Care will have to be exercised in handling the machine on curves of 8 in. elevation. In some territories it will be difficult to use the machine on account of insufficient room to place it off the track, but if turned, it takes no more room than the hand car."

On another road a record was kept of the renewal of 80-lb. rail with 90-lb. over a distance of 18.36 miles, with an average of 39 native Americans in the gang. The average miles laid per day was 0.99, with an average delay of 35 min. for trains. The cost of laying the rail was $90.59 per mile. The Madden track layer is sold by the Madden Company, Chicago.



A Section Devoted to Methods of Increasing Output, Improving Living and Working Conditions and Making Service More Attractive

WHILE THE CURRENT scarcity of men is not confined to the railways, but is common to all industries, the roads are among the first to suffer at times of labor shortage. A number of railway men are beginning to realize that more attractive living conditions are one means of overcoming this condition and that they must be offered laborers if these men are to be retained in railway service, and as a result marked improvements are to be found in the accommodations provided on several roads. Several of the more modern camps are described, while the methods of feeding the men by contract and by company-operated camps are set forth with the advantages of each. More attention is also being given to methods of increasing the efficiency of maintenance of way laborers by the standardization of work, by education and by offering them incentives for the exertion of their best efforts. Several of these plans are described in detail in this section.

Examples of Modern Labor Camps

THE VITAL importance of the proper housing and feeding of laborers as a factor in holding them in the service has been dwelt upon frequently in these columns during the last year and discussions of the prime considerations to be taken into account in the proper design, installation and operation of the camps to insure the highest practicable degree of comfort, sanitation and general attractiveness of the surroundings have appeared from time to time. Railroads have generally given this problem more consideration during the past year than ever before and a number of them have made marked improvements in the character of their camps. As an indication of the work that is being done along this line several camps recently completed are described on this and following pages.

ILLINOIS CENTRAL CAMP AT WILDWOOD

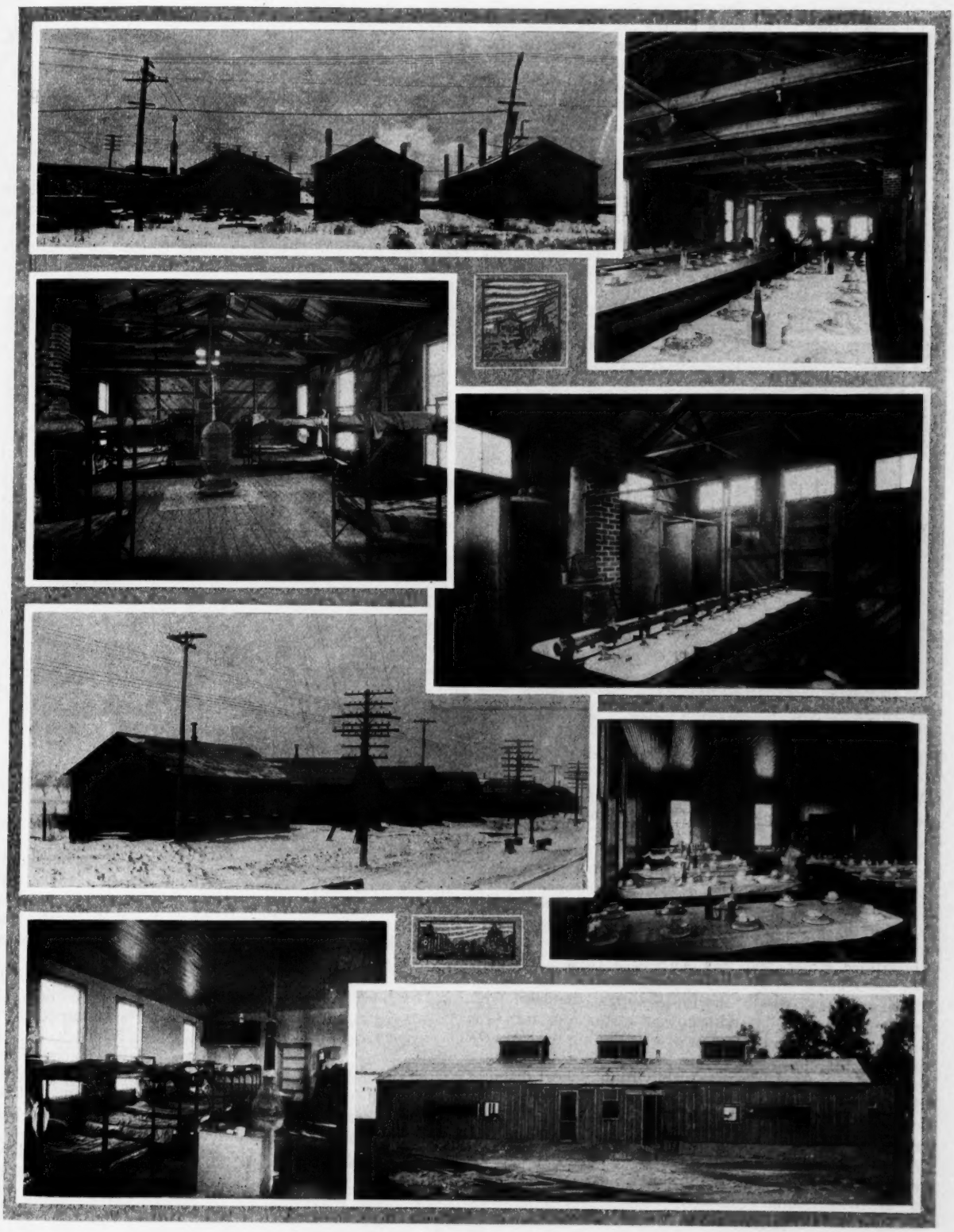
A number of interesting improvements are embodied in a camp built by the Illinois Central for laborers working on maintenance and on yard improvements at Wildwood, a station near the southern city limits of Chicago. It is composed of eight bunk houses, a commissary building, two lavatory buildings, quarters for the commissary help, and a hospital building.

The structures are of a uniform type, set on wooden posts and four lines of 6-in. by 8-in. stringers. The floors are of wood with the exception of those in the lavatory buildings which are of concrete. The walls consist of 2-in. by 4-in. studding placed 4 ft. center to center with girts between and covered on the outside with 1-in. by 10-in. boards placed vertically, the cracks between them being battened with 1-in. by 2-in. strips. On the interior both the walls and ceiling are finished in beaded ceiling and painted. The roofs are covered with ready roofing, while the walls are provided with an ample number of double-sash windows properly screened. The screens are stored during the winter months in the rooms to which they belong.

All of the houses are equipped with electric lights, the power being purchased from the local public utility company and all lighting circuits are enclosed in conduit to conform with regulations of the City of Chicago. All of the buildings are heated by cast iron stoves of the type commonly used in small passenger stations, the stove in each case being generally in the center of the room with a stove pipe going out through the roof, which is protected from fire by a smoke jack. As a further protection against fire each building is supplied with a 2½-gal. fire extinguisher.

The standard bunk house is 22 ft. by 40 ft., with a door at each end and 4 windows on each side. There are 10 double-deck steel bunks on each side of the room, thus providing accommodation for 40 men in each house. In addition to the bunks and stove, the furniture includes a coal box and a table placed in the aisle between the bunks. Three 25-watt electric lamps are suspended from the ceiling by drop cords, and are controlled from a switch near the door. The railroad furnishes each man with bedding, consisting of a mattress, two blankets and a pillow.

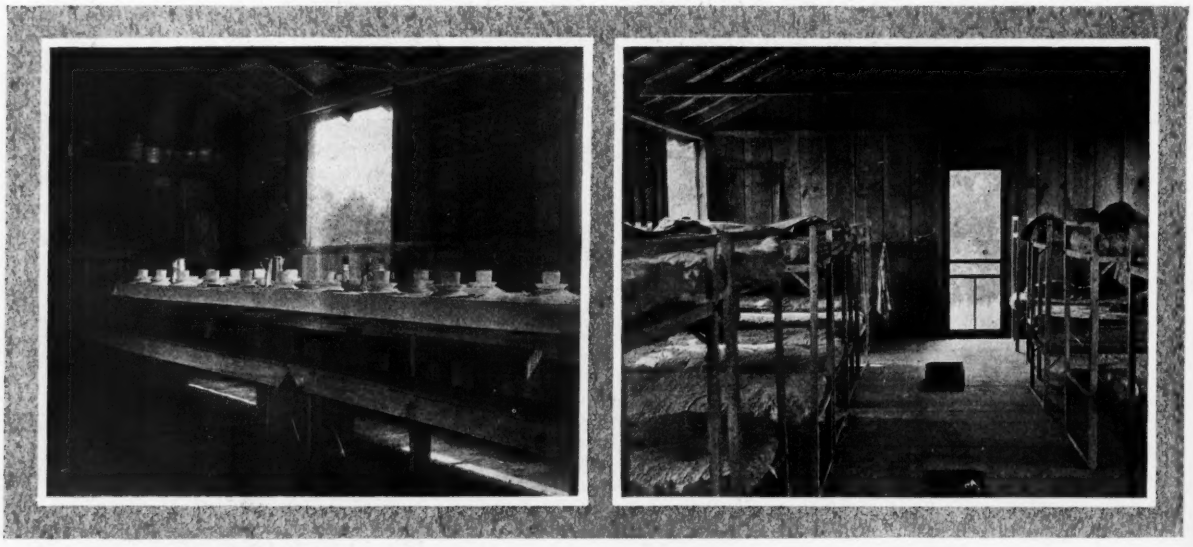
The commissary building is in the shape of a "U" and was originally designed for two mess halls, 22 ft. by 50 ft. with a kitchen 20 ft. square between. With the number of men employed it is possible to feed nearly all of them in one of the rooms so that only a portion of the other one is used for feeding the men, the remaining space being used for storage and for a commissary store, where the men may purchase necessary supplies, tobacco, clothing, etc., and are afforded safe storage of any valuables they may have.



Camp Views at Chicago—From Left to Right, Beginning at the Top—The Camp Buildings, Dining Room, Bunk House and Lavatory, Pennsylvania Camp; Camp Buildings, Dining Room and Bunk House, Illinois Central Camp; Rock Island Camp Building.

The men are fed by a boarding contractor, who supplies a working force of five waiters, two cooks, a baker and a dishwasher. The bunk houses are swept out and otherwise kept in order by two men, employed by the railroad, one during the day and one at night. These men are commissioned with the further duties of supplying coal for the stoves in the various houses and of removing the ashes.

Particular pains have been taken in the installation and construction of the lavatory buildings, the interior of one being shown in a photograph. High grade fixtures have been used to insure ease of maintenance. The accompanying plan shows the arrangement of the various facilities. A hot water heating plant supplies hot water to the 16 wash basins and 4 shower baths and serves also to heat the room with the assistance of a cast iron stove. The caretakers mentioned above are expected to spend ample time in keeping the lavatories in good condition.



INTERIORS OF MESS HALL AND BUNK HOUSE, BALTIMORE & OHIO CAMP AT FOLSOM, PA.

PENNSYLVANIA LINES CAMP AT CHICAGO

Another new camp in Chicago is that completed late last year by the Pennsylvania Lines for track elevation forces. It is located on Hoyne avenue just north of Sixty-third street, and was built at a cost of $13,000. The high grade of construction implied by this expenditure resulted from a desire to supply the men with sanitary, comfortable and wholesome quarters and to a certain extent from the necessity of fulfilling the requirements of the city building and health departments, since the camp is located conspicuously within a short distance of an important city street.

The layout is uunsually compact. There are five bunkhouses, a lavatory and a mess building. The buildings are of a uniform design and of a unit-constructed, portable type that can be taken down and reused entire except for the brick chimneys constructed to fulfill the requirements of the city authorities. The side walls are built in panels with 2-in. by 4-in. studs and girts and a 4-in. by 4-in. header at the top. These side wall units are double sheathed on the outside. The under layer is ⅞-in. ship-lap placed diagonally and the outside layer is 1-in. by 10-in. boards placed vertically, with the joints covered by 1-in. by 2-in. battens. A layer of building paper is placed between the two layers of sheathing. The units are assembled by bolting the adjoining sections together with ½-in. bolts fastened through adjoining studs and by similar fastenings to the floor.

The roof consists of similar units made up of 1½-in. tongue and grooved sheathing laid on 2-in. by 4-in. purlins and carried on roof trusses composed of 2-in. by 6-in. pieces bolted together. These roof trusses are mounted on the previously assembled side wall units, being bolted to the 4-in. by 4-in. headers previously mentioned. The roof trusses are spaced 6 ft. apart or about half the width of the roof units, but the trusses are doubled up at the joints between the adjoining units. The roof covering is ready roofing which can remain in place when the buildings are dismantled, except for the cuts made at the junctions of the units. The interior is not ceiled, the roof trusses being exposed on the interior. Each of the bunk houses is furnished with two cast iron ventilators and the mess building with four.

The bunk houses are 42 ft. by 22 ft. and contain 12 double deck steel bunks accommodating 24 men. Three of the bunks are placed in each corner of the room, to leave a space approximately 13 ft. by 21 ft. in the center of the room around the stove to serve as a lounging space for the men.

The mess hall is 23 ft. by 68 ft. and is equipped with six tables, each of which will accommodate 26 men. It is lighted by 18 electric lamps and 14 large windows.

The kitchen occupies a lean-to 15 ft. by 28 ft. built in the rear of the center of the mess hall. Except for a sink and tub at one end of the room used for washing dishes all the space is used for cooking and baking. Supplies are kept in a refrigerator car set out on a temporary stub-track behind the kitchen.

The lavatory building follows the same general arrangement as that used by the Illinois Central, except that it is slightly smaller, being 18 ft. by 20 ft. in plan and contains 12 wash basins instead of 16. Otherwise the equipment is practically the same. The building is located centrally in the group, so as to be of convenient access from all of the others.

The boarding is handled through a contractor, whose force is responsible for the feeding of the men and the

maintenance of the mess building. The railroad company provides a man to look after the other buildings. To insure that they are maintained in a sanitary condition the bedding is washed frequently and subjected to periodic treatment with a West disinfector to eliminate vermin.

THE FOLSOM CAMP ON THE BALTIMORE & OHIO

During the past season the Baltimore & Ohio erected a number of camps for men employed in section as well as extra gang work. The men were hauled to and from their work for distances as great as 20 miles on motor cars and trailers. One camp used under this system which was installed at Folsom, Pa., to accommodate a total of 96 men, including the foreman, embodies a number of features of interest. It consists of two bunk houses, a boarding house, two toilet rooms and a shower bath. One factor complicating the design of this camp is the fact that it was necessary to provide for both white and colored laborers, as a result of which most of the facilities are in duplicate or were subdivided.

There are two bunk houses 20 ft. by 60 ft., one for the white men and one for the negroes; a room 18 ft. by 18 ft. is partitioned off the white bunk house for the use of the foremen. The equipment in these houses consists of 24 double deck steel bunks. Combination felt and straw mattresses are used and blankets are furnished by the commissary company. The windows and doors are all screened.

The boarding house is 20 ft. by 50 ft., the front of which is used as a commissary store, the center as a dining room and the rear as a kitchen. The largest room is the dining room, which is 30 ft. long and is provided with two long wooden tables, one for each race, occupying separate sides of the room. The tables are covered with white oil cloth, the food is served on large platters or porcelain pans and the men help themselves. To the rear of the kitchen is a small lean-to 11 ft. by 12 ft., which serves as quarters for the cook, while an ice-box and small slatted box in which to keep vegetables were built on the side of the building next to the kitchen.

The lavatory facilities consist of a wooden wash table about 30 ft. to the rear of the bunk houses, provided with tin wash basins and supplied with water from a double water faucet at each end of the table. For bathing the men are provided with shower baths, consisting of a small enclosure boarded up, with a water spigot about 8 ft. above the floor. Attached to this is a bucket with a perforated bottom to furnish the shower. A pit toilet divided into two parts for segregating the colored men is located about 60 ft. to the rear of the bunk houses. A separate toilet is also provided for the commissary employees.

Two Ways of Feeding Maintenance Laborers

THE RAILWAYS HAVE SOLVED the problem of providing camps for the feeding and housing of these employees in two ways. In some instances the roads have assumed this responsibility themselves, but in most cases they have placed this work in the hands of contractors specializing in the feeding of men. Each system has its advantages and disadvantages.

In the articles which follow the manner in which the contractors and railways operate their camps are described. In the first article the methods of the contractor are outlined by an officer of one of the large and successful commissary and boarding companies. The second article describes methods in company-operated camps on the New York, New Haven & Hartford and the Pennsylvania, two roads which have given this subject careful attention in recent years.

FEEDING MEN BY CONTRACT

By P. H. Butler

President, Chicago Commissary Company, Chicago.

As an officer of a company which has been identified with the boarding of all classes of railroad labor on some of the principal trunk lines of the country for the past twenty years, I am assuming that this article will be of interest to two distinct classes of railroad officers, viz., those who undertake to board their own laborers and those who delegate this perplexing task to men who specialize in this particular endeavor. Consequently, it is intended for the edification to the one while submitted for the approbation of the other.

Assuming that a railroad officer desires to turn over the responsibility of boarding the men to a contractor, it is apparent that the first step would be the selection of a responsible boarding company with which to close a mutually satisfactory contract. This done, a spirit of co-operation must prevail in order that the best results may be obtained. It necessarily devolves upon the railroad officer to outline to the contractor a schedule of the probable season's business, specifying the number of camps of the various sizes needed, that is, so many 20-man camps, so many 50-man camps and so many 100-man camps as the exigencies may require, and also specifying whether the men are to be housed in box cars provided and equipped for the purpose, or in shacks of a temporary character, or in permanent buildings near work in progress for an indefinite period.

A properly organized commissary company is prepared to supply the necessary plans so that the railroad carpenters may convert unused box cars into a well arranged boarding camp with the least labor and expense. Blue prints and advice are also to be had in the building and arrangement of ordinary stationary camps as well as the establishment and equipment of the most up to date arrangement with hot and cold water, shower baths, and such other comforts as the company may feel called upon to place at the disposal of their laborers.

Once the housing is provided for, the officer in charge notifies the contractor that he wants the camp opened at a specified date, and the equipment, camp help and supplies will be on the ground at the time specified. At the instance of the foreman in charge, laborers will be delivered, fed a good meal and the work started at a specified time. In cases of emergency, a camp outfit may be loaded from the nearest warehouse of the boarding contractor and supplies, equipment and the camp crew rushed on the same train so that meals can be served from two to three hours after arrival at destination.

Supplying Men

In addition to the free employment agencies maintained and operated by themselves with the express pur-

pose of keeping camps filled to capacity, the boarding contractors usually have affiliations with responsible agencies throughout the country so that whatever labor is available is obtained from the nearest center. Daily telegrams from their representatives on the ground show the conditions and special efforts are made to make up any deficiency. When it is considered that the profit of the contractor is centered in the board of the men, it will be seen that it is to his interest not only to keep the gangs filled, but to exercise discrimination in the selection of men, so that those who are sent will go to work and stick to it as long as may be expected of this class of labor.

REQUISITES OF A GOOD CAMP

It goes without saying that the vital element in a satisfactory boarding camp is the character of and the manner in which the meals are served. There is but one satisfactory solution and that lies in the competency of the cook and through years of participation in the business the contractor can surround himself with experts in this line who know camp cooking as a distinct vocation. In addition it is the practice of some firms to keep in touch with men who cook in the woods during the winter and who avail themselves of any opportunities offered for employment during the busy summer season.

Next come the commissary clerks, the personal representatives of the contractor who keep the camp accounts and have general supervision over the camps of which they are in charge. It is the duty of the clerk to render a daily report which is a continuous inventory, showing even to the fraction of an ounce of pepper the quantity of supplies on hand. A stock sheet posted from these reports shows at a glance the immediate needs of the camp and which can be as quickly supplied. It must be remembered that the profits of the contractor lies in the elimination of waste. With the stock sheet references and a knowledge of the requirements of each individual cook which it discloses, no camp is burdened with an excess while another is lacking in the essentials.

An important factor in establishing a settled frame of mind in the laborer is the maintenance of a commissary department. Here he may obtain his tobacco, overalls, shirts, socks and such other apparent necessities without resorting to the final expedient of quitting his job in order to get the ready money with which to purchase them.

CONTRACTOR'S ADVANTAGE IN PURCHASES

With the stock sheet as a reference a responsible officer of the company attends to the supplying of the camps. When a camp is opened it is stocked with a six weeks' supply of everything used in the preparation of meals with the exception of fresh meats, vegetables and other perishables. Near the end of the month an order is made up in the main office, using the stock sheet as a basis and supplies are shipped so as to reach camp in time to stock up for another six weeks, thus eliminating the possibilities of running short of stock.

Meats are sent to the camps twice a week in the cooler months and thrice weekly in the summer months. All meats are packed in ice cases at the packing houses in Chicago, forwarded in refrigerator cars to the branch house of the packing company nearest the point where the camp is located. These branch houses re-ice the cases and send them out by express, baggage or auto trucks, as the circumstances warrant. Vegetables and seasonable greens are ordered on certain days from the nearest market when quantity and variety may be obtained, thus overcoming the embarrassment of local purchasing where neither variety or quantity may be had.

It will be seen readily from the above that no set "bill of fare" should be established. Nationality, climatic conditions and the character of work are also determining factors in the preparation of meals. Beef, veal, mutton, kidneys, liver, hearts, frankfurts, bologna, bacon, dried salt sides and pork furnish a variety distributed over a two weeks' period, that so far as meat is concerned covers almost any requirement.

MUST CATER TO LABORERS' TASTES

Where negro labor is employed, negro tastes are catered to. Where other races or nationalities are to be fed, their particular inclinations are considered. The matter of satisfying the laborer is clearly up to the contractor or he must suffer a loss.

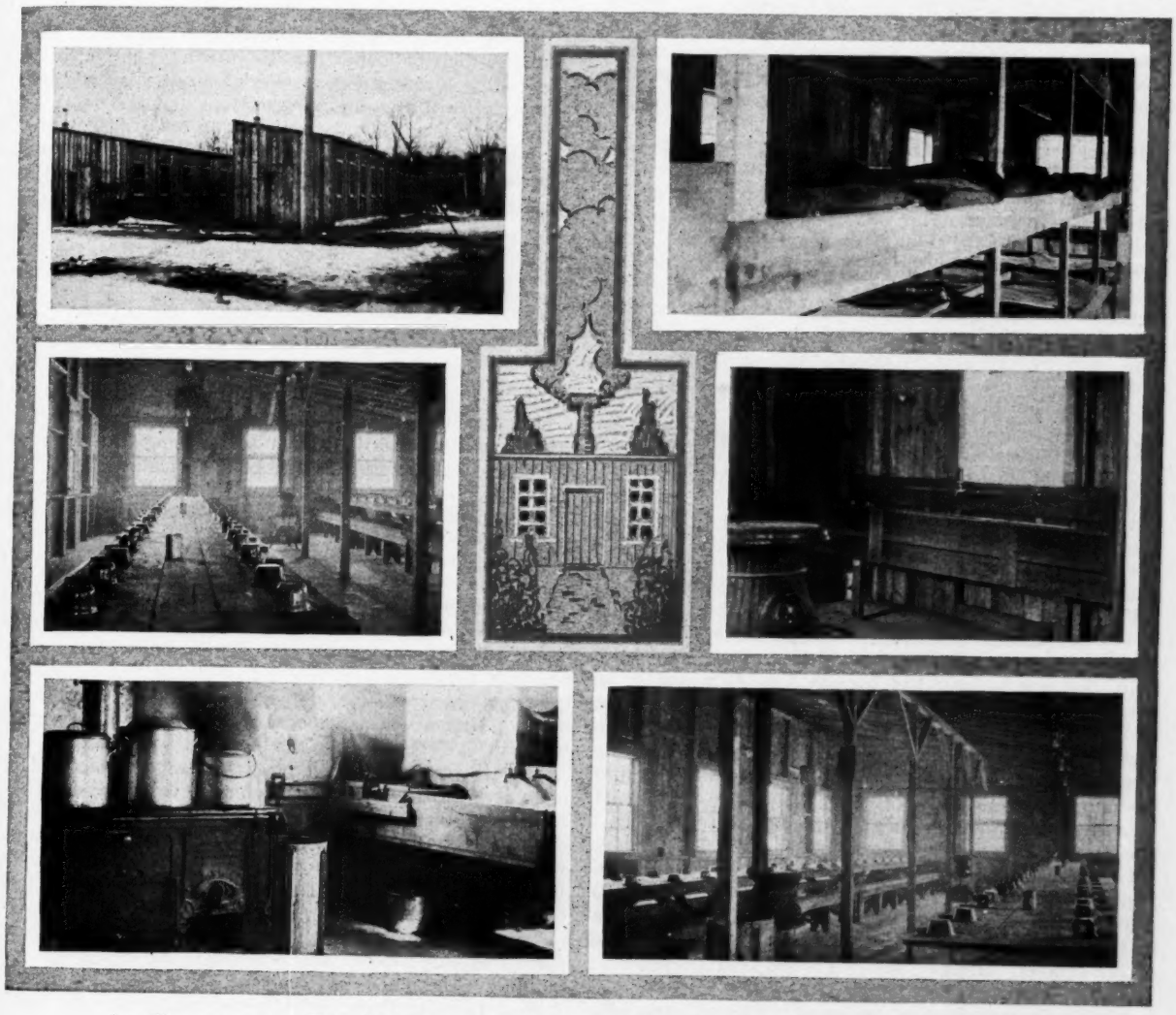
Before the war it was possible for him to obtain contract prices on meats, flour, sugar and the 104 other staples used by him in conducting his business. He could then make a flat rate of board for the year. But the year 1917 developed new conditions. With an erratic market, jobbers unwilling to maintain equitable quotations and certain foodstuffs limited in supply and distribution, it followed that the rate of board has had to be readjusted periodically to meet prevailing market conditions, sometimes even necessitating a higher board rate than prevalent wages warranted the laborer in paying. Consequently certain railroads have seen fit to assume the difference in order that the wage scale might not be disturbed. To illustrate, during the year, 1917, the company represented by the writer served approximately 2,160,000 meals in camps of all sizes from 5 men in an out of the way place to 100 men in better territory. The cost of food, wages to camp help, labor furnished, supervision and all overhead expenses gave an average total cost of about 28 cents per meal. The laborer was charged a board rate of from $4 per week, or 19.05 cents per meal, to $5 per week, or 23.4 cents per meal, according to the rate of pay. The difference between the rate charged to men and the rate allowed the boarding contractor was absorbed by the railroad.

COMPANY-OPERATED CAMPS ON THE NEW HAVEN

Company-operated labor camps were introduced on the New York, New Haven & Hartford to provide sleeping quarters and food for men recruited in distant points. When, because of the difficulty of securing labor locally to carry on maintenance, construction and freight handling work, it was found necessary to establish such camps, it was decided that the company had ample facilities for carrying on the work itself and would not need to fall back upon the contract plan of feeding the men. Five camps were opened for laborers in July, 1916. By September the number of these camps had been increased to twelve. Additional camps were opened in rapid succession after that date and during the rush periods of the 1917 season, 28 camps were operated. These camps had a combined capacity for accommodating approximately 1,200 men.

The men living in the camps on each division work under the direction of the various division superintendents and division engineers as do the timekeepers for each gang. When a bunch of men is recruited and sent to a camp as much advance notice as possible is given of the arrival and the men are received into the camp by the division timekeeper and by him added to the rolls, and given a number and a brass check entitling the holder to one meal. As the men are recruited in locali-

ties remote from the work it is desirable that they be guaranteed a certain term of employment. Also in recruiting the men and in transporting them to the work the company incurs a certain expense for each man hired and it is desirable that it be guaranteed a certain time of service by the men. For these reasons a contract is made with each man employed. The term of the contract is three months, and as an incentive to the men to remain on the work the company agrees to furnish transportation from the job to the point of enrollment for all men who complete the three months' service. The men contract to pay $4 per week for 21 meals and lodging, but have the privilege of paying only for such meals as they eat at the rate of 19 cents per meal. By this arrangement, which means that no charge is made for lodging, men working at a distance from the camp at noon may buy their lunch where they please instead of eating a lunch put up at the camp for them to carry.



AN EXTERIOR AND FIVE INTERIOR VIEWS OF THE NEW HAVEN CAMP AT ISLINGTON, MASS.

ORGANIZATION AND METHODS

The organization for feeding the men is independent of the divisions and is headed by the superintendent of dining cars. For convenience the camps are administered in groups. The assistant superintendent of dining cars is in charge of the Boston group, a labor camp steward located at New Haven, Conn., is in charge of the 12 camps in that vicinity and the stewards of the company-operated restaurants at Providence, R. I., and Waterbury, Hartford, Berlin and Midway, Conn., are each in charge of camps in their vicitities.

Each camp is in charge of a chef, who directs the work of the cooks, waiters and janitors in his camp. The chef also makes up the daily menu, orders supplies and keeps the accounts for the camp. The duties of the janitor are to spray and wash the camp, keeping it clean at all times. He also airs the bedding, makes the beds and sees to the sending of soiled bedding to the laundry. Two janitors are employed in the larger camps and one in the smaller ones.

As there is a better feeling in the community toward the camps when the supplies are purchased locally, it is the policy of the organization to patronize the stores and markets in the vicinity of the camp, provided the prices are right. This procedure is especially desirable in the purchase of green vegetables and other perishables and is followed as far as possible with staples. When a purchase of staples is to be made, the prices at headquarters and other large markets are secured and, considering han-

dling, freight, etc., the purchase is made at the cheapest market. With prices on a par, the local market is given preference.

The local purchases for camps are all made by the steward in charge. Each day he communicates with his camps and learns through the chef what the wants are. At the same time the chef reports the number of men in the camp, and the steward orders according to his judgment of the requirements.

As the supplies are delivered the chef is given a sales slip by the dealer and after it is checked to make certain that all the goods called for were delivered, it is approved by the chef and sent to his steward. At the end of the month the dealer sends the steward a monthly bill, which is checked against the daily bills, approved and sent to headquarters, where it is signed by the superintendent of dining cars. It is then turned over to the accounting department, where it is audited before passing it on to the treasurer, who vouchers the bill.

It has been mentioned already that as the men are received in a camp they are given a brass check which entitles the holder to one meal. These checks are issued for the convenience of the chef in keeping his accounts and as evidence of the right of the diner to a meal. These checks are collected by the chef during each meal. By keeping a count of the checks collected the chef is able to report to the superintendent of dining cars at the end of the week how many meals he has served each day. This information is necessary in arriving at the cost per meal.

THE COST OF MEALS

In busy times the small camps feed an average of from 10 to 12 men per day, while in the larger camps the range is from 75 to 150 men. As practically the same organization is necessary in the smaller camps as in the large ones, the price per meal runs higher in the small camps. For food alone, during July, 1917, the increased cost per meal in a small camp was 10 cents above the average.

For three months in 1915, in which 38,000 meals were served per month, the average cost per meal for food alone ranged from 11.6 cents to 13.4 cents. In July, 1916, the average cost had increased to 18.6 cents. In July, 1917, 64,000 meals were served at an average cost of 24.6 cents. Meals at the smaller camps during this same month averaged 35 cents. In August, 71,000 meals were served at a cost of 21 cents each. In September the number of men fed decreased and the cost per meal increased to 23.3 cents. With still less men fed in October the cost advanced to 25 cents per meal. In October, 1917, the labor cost per meal amounted to 7 cents, in September, 8 cents, in July, 9 cents, and in August, 10 cents. The increased cost in July and August was due to the employment of a "Bug Squad" to fight vermin in the smaller camps.

The fluctuation in the number of men fed in the camps results in increased costs per meal. This is especially true of the large camps. The chef plans his meals for a day from the number of men fed at supper on the preceding day. His arrangements may be made for feeding 125 men and a certain number of the men may quit or desire to avail themselves of the privilege of eating outside of the camp. Of the over supply of food prepared, a certain per cent is waste and cannot be worked into future meals. On the other hand, he may prepare for 75 men and a new bunch may be delivered to the camp, making it necessary to prepare extra meals. On such occasions the chef must depart from the menu for the day and prepare the meals from the emergency supplies, often at an increased cost per meal.

Another source of loss is through feeding men from one to five meals without receiving any service. If a new gang be delivered on Saturday night they must be given supper that night, three meals on Sunday, and breakfast on Monday. A certain proportion of the men in each new gang will walk away without starting to work and as the pay for the meals is deducted from the wages, a dead loss results. If the delivery of the men is made on any other day, the loss from this cause is, of course, less,

THE MENUS

While general instructions are issued from headquarters and from the stewards to the chef concerning what is to be served and especially what is not to be, the details of making the menus are left largely to the chef. This is done so that the menus may be varied for the different races. Fish is served twice a week for the Irish and rice frequently for the southern negro.

The menus are varied as much as in the average home and it is intended that each man shall have plenty. There is no limit on the "helpings." The menus for a day in one of the camps follows:

Breakfast	Lunch (in camp)	Lunch (to be carried)	Supper
2 eggs	Turnips	4 sandwiches	Roast beef
Potatoes	Beef stew	Coffee	Tomatoes
Bread and butter	Potatoes	(Cheese is used extensively)	Potatoes
Coffee	Bread and butter		Bread and butter
	Coffee		Bread pudding
			Coffee

Hot muffins or cakes are often served instead of bread and for breakfast either liver, ham, frankfurters, sausage or hash is served frequently instead of eggs. A monthly bill for meat includes roast beef, veal, pork, lamb, corned beef, chops of various kinds, ham, frankfurters, liver, sausages.

THE CAMPS

The camps vary widely, both in capacity and physical characteristics. Of the 28 camps, 20 are small and consist of converted passenger cars for sleeping quarters and box cars for kitchen facilities; at Putnam, Conn., an old building was remodeled; seven camps have been built new. These seven are modern and are equipped with telephones, electric lights and hot and cold water.

The camp at Islington, Mass., which accommodates 150 men, is typical of the newly constructed camps. This comprises six bunk houses, a recreation building and a mess building. All of the structures are of substantial frame construction, well ventilated and lighted, and founded on concrete. The floors in all the buildings are of concrete.

The bunk houses are fitted with wooden bunks arranged in three tiers, placed through the center of the building with an aisle space all the way around the bunks. A coal burning stove in each end moderates the temperature in severe weather.

The recreation buildings contain a reading room, furnished with a table and benches, and a wall seat around three sides of the room. Six shower baths are provided in the recreation building, as is an open sink for the use of the men in washing up for meals. The reading room and bathrooms are separated by partitions.

The mess building contains the kitchen, dining room and chef's room. The kitchen is fitted with a stove which burns either coke or coal, a hot water apparatus connected with the stove, a zinc-lined sink and drain for dishes, a refrigerator and a serving table. One side of the kitchen is entirely taken up with shelves, which are

used for storing supplies which will not be injured by the heat of the stove.

The dining room has a seating capacity for 150 men. The table runs through the center of the room for its entire length except for one passageway for the waiters. Benches are provided for seats. The room contains two stoves, which are utilized both for heating purposes in cold weather and also to keep the food hot during the meals. At other camps the arrangement of the dining room is varied and the tables are placed against the walls with the seats on the inside of the hollow square. The Islington arrangement is preferred by the men, as it is the more homelike plan, inasmuch as the men are not required to face a blank wall during meals.

THE PENNSYLVANIA PLAN

The organization for feeding the men employed in the company-operated camps on the Pennsylvania is headed by a commissary agent, one agent having charge of all the camps on a grand division. Each camp is in charge of a commissary clerk, who is generally an experienced restaurant man selected for his knowledge of cooking and his judgment in ordering supplies. He should also have had some clerical experience, as he keeps all the accounts of the camp in addition to his other duties of ordering supplies, making up menus and directing the work of the cooks, waiters and janitors. In camps operated for track men he is carried on the supervisor's roll and on the master mechanic's roll if the camp is maintained for shop men.

METHODS OF PURCHASING

All purchases for the camp are made by a clerk under the direction of the agent. The agent selects the dealers from whom the clerk may buy on the basis of competitive bids and decides on the nature of the purchases to be made at any time from his knowledge of market conditions. As a result of this close study of the market the agent is able to direct the purchases so that economies may be effected while still maintaining balanced rations. For instance, it may be an economy to serve beefsteak at times instead of ham and vice versa. Changing from one to the other with the changes in the market prices will not be detrimental to the laborers.

With each purchase the dealer is required to furnish an original bill made out on a Pennsylvania Railroad standard form and a duplicate. The original bill is sent direct to the purchasing department and the duplicate invoice goes to the camp clerk with every bill of goods and a check on deliveries. The original bills are sent to the clerk for certification before payment is made through the regular channel.

THE MENUS

The menus for camp are made up by the clerk and vary with the season and conditions of the market. National characteristics of the men in a camp are considered in preparing the menus and particular care is taken to insure balanced rations and to avoid improper combinations. As mentioned previously, the menus for each camp are now prepared by the clerk, but studies are being made by the agent of the various grand divisions to the end that the menus may be standardized. It is felt that by standardizing the menus the health of the men will be assured. There is the additional advantage of having conditions equal in all camps, then if the men drift from one camp to another or are transferred, it is felt that they will be satisfied in one camp as in another. With the menu left to the clerk in charge, the personal element develops and the men of one camp will be better fed than those in others. A general week-day menu is shown below:

Breakfast	Lunch		Evening Meal
	In camp	To be carried	
*Fried meats	Soup	4 sandwiches	Cornbeef and cabbage
*Potatoes	2 sandwiches	Cake	Potatoes or Roast Potatoes
Bread and butter	Cake	Fruit or jelly	Vegetable
Coffee	Fruit or jelly	Coffee	Bread and butter
	Coffee		Dessert
			Coffee

*Stews substituted for meat and potatoes occasionally.

The laborers for these camps are recruited in the large cities or other available source of supply by employment agencies maintained by the company. The recruiting is done ahead of the need and the demands for men are met as they come. These men are hired at a rate which is kept two cents below the rate paid regular section men as an incentive for the men to enter the section gangs and maintain themselves.

The standard camp on the Pennsylvania consists of a battery of four bungalows under one roof, each battery accommodating 60 men. The end bungalows are used exclusively for sleeping quarters, each accommodating 24 men. The third bungalow contains sleeping quarters for 12 men and toilets, baths and the tubs used by the men for washing their clothes. The fourth building contains the kitchen and dining room.

Remodeled buildings are also utilized for camp purposes and some of the smaller camps consist of converted box cars. These last are being rapidly replaced by standard buildings. All camps are supplied with hot and cold water and sanitary toilet facilities. Waterless toilets are used in all camps where water closets are not practical.

ADVANTAGES OF COMPANY CAMPS

In establishing labor camps certain preliminary expenses are incurred in recruiting the men, for transportation and for feeding en route. Unless some service is given by a man in return the preliminary investment in the individual is lost. A certain per cent of the men hired and transported to the camp leave without giving any service and others desert while en route. If it is necessary to run the commissary at a profit the men who stay on must make up this loss, either by paying more for board or by eating less food or a poorer quality of food.

In the New Haven's operated camps this loss is absorbed directly by the company and there is no cutting down in the quantity or the quality of food and the company is thus ensured of well-nourished men. If the loss be made up on the men who stay the company absorbs it indirectly as dissatisfied or under-nourished men make for excessive cost per work unit.

In company-operated camps certain practices can also be introduced as an incentive to a man to stay on the work which are impractical if the contract system is followed. On the New Haven it is the policy of the company to reduce the rate for board from $4 to $3.50 per week to all men who complete a four weeks' term of service. In this way a virtual raise in wages can be given the men in the camp without interfering with the basic rate on the system.

Because of the nature of the men employed under such a system the labor turnover is frequent and while no plan of feeding can be expected to overcome the drifting tendency, by feeding the men itself the road knows that they are properly fed and that there is no reasonable ground for complaint regarding the quality or the quantity of the food the men receive.

On the New Jersey division of the Pennsylvania with a force ranging from 800 men in summer to 600 men in winter, the average term of service is about 60 days, being longer in winter than in summer. In spite of this rapid turnover, the employment departments have been fairly successful in keeping the gang full.

Permanent Track Forces Economical

ONE OF THE MOST serious objections to track work on the part of the better class of laborers is its seasonal character. It has been the almost universal practice to lay off a large part of the force at the approach of winter. Realizing the inefficiency of this practice, two roads have placed their maintenance forces on a permanent basis. The results are described by trackmen on these roads in articles which are published below.

FIVE YEARS ON THE LONG ISLAND

By G. P. WILLIAMS

Assistant Engineer Maintenance of Way, Long Island Railroad, Jamaica, N. Y.

In the early part of the year 1913 work of all kinds was very plentiful on Long Island, the demand for labor being far in excess of the supply. This, in conjunction with the increased cost of living which was beginning to be felt at this time, caused a corresponding increase in the wages of laborers. Contractors, farmers and other employers of laborers who required a large number of laborers during the summer months were, of course, quick to realize this, and in order to attract the required number of laborers they paid as high as $2 per day of eight or nine hours for the common ordinary every day Italian laborer. This condition finally became so serious that it was necessary to do something to counteract it, and it was felt that if the organization and the program of work for the year could be so rearranged that the laborers could be promised permanent employment, it would be possible, in spite of the fact that smaller wages were paid, to attract a more desirable class of men.

Consequently, on May 16, 1913, the permanent track forces were organized. By that is meant a force which remains the same the entire year. The average mileage of each section is 5½ miles of main track and 4½ miles of sidings. Including sub-foremen, the average number of men per section over the entire system is 4½ men. The first step in developing this organization was to divide the sections into five classes; the first class, including the important terminals and yards. Each successive class was reduced one man under this scheme. The eighth class, or the one made up of the least number of men, was allowed four men, including the sub-foreman, as compared with an annual average of five men under the old arrangement. The plan is shown in the table:

Class	Sections in each class	Laborers per section. Old scheme	New scheme	Number of laborers. Old scheme	New scheme
1	1	10	8	10	8
2	2	8½	8	17	16
3	3	8	7	24	21
4	6	6¼	6	39	36
5	32	6⅓	5	203	160
6	32	5½	4	176	128
7	1	4	4	4	4
8	22	5	4	110	88
				583	461

Since 1913 it has been necessary to add to these new sections and also in a few cases to add to the number of men on the existing sections, due to the construciton of increased mileage on the sections in question.

Under this plan it should be noted that the entire section forces on the railroad has decreased about 20 per cent. At the same time an increase of 2½ cents per hour was given to the laborers with a corresponding increase to the foremen and sub-foremen. When this organization was put into effect the foremen were all carefully drilled as to just what was expected of them under the new arrangement. They were instructed gradually to weed out the poor men in their gangs and replace them with better ones, using good judgment, however, so as to not cripple the section by letting all the inferior men go all at one time.

In employing laborers, they were given to understand that they could depend on being permanently employed and that they would not be dropped without good reasons. We also impressed upon them that they would be accorded the same treatment that men of a higher grade in railroad employ are usually accorded. In other words, they would be granted a hearing by the supervisor in charge of his division if they were not satisfied with the decision of their foremen.

After all these points were thoroughly drilled into the foremen, the heads of departments took up the question of arranging for a systematic distribution of the work throughout the year. The first step was to rearrange the existing schedule for making tie renewals. Under the old arrangement practically all such renewals were made between the middle of March and the first of July. This, of course, required a very large increase in section forces and also the use of extra gangs on this work, but under the new scheme tie renewals were started in the fall about the middle of September, as soon as the heavy passenger travel was over, being careful, however, not to continue the work so late in the season as to cause the track to become frozen solid without having the ties properly bedded in the track.

During the three summer months when the traffic is so heavy and the work on the main track curtailed, all necessary repairs are made to the sidetracks, including tie renewals and mowing of the right-of-way. During this period the necessary frog, switch and guard rail and switch timber renewals must also be made. The period from September 1 to about the latter part of the month is devoted to the improvement of the line and surface of the main track, cleaning ditches, trimming ballast and doing the necessary policing. After the annual track inspection, work is started on making the main track tight. Tie renewals are pushed vigorously and prosecuted until weather prevents it. As soon as the ground freezes up and throughout the winter, the section gangs devote their time to cleaning culverts and drains, repairing right-of-way fences, renewals of frogs, switches and guard rails, and such minor repairs to track fastenings as may be necessary, repairing and renewing crossing plank, track signs, track gaging, tie plate installations and the distribution of ties for the spring renewals.

In addition to this, of course, the section gangs take care of the usual snow and ice troubles, together with other incidental jobs which can be taken care of during

the winter months. The aim is to be as far advanced as possible, so that when the weather moderates in the spring, it is possible to do the work allotted to those months. Bolts are tightened at the same time that the surface imperfections are taken care of in the spring and fall.

Practically all of our rail relaying and the construction of new tracks is done by extra gangs. This organization has now been in effect for nearly five years, and it has been found that the assurance of permanent employment at a fair rate of wages has practically eliminated the shifting about of men and the consequent necessity of breaking in green men. During the first three years this organization was in effect it was possible to pick and hold men that were really wanted and it is safe to say that at the end of this three-year period fully 90 per cent of the original men were still on the force and at this time the improvement in the condition of the tracks and other appurtenances taken care of by the track forces proves that the expectations had been more than realized.

During the past two years, however, conditions have changed so materially that the track organization has undergone material changes in personnel. At this writing, however, a careful check showed that 60 per cent of the men who were employed two years ago are still on the payrolls, and at no time during the past two years has the total of the track organization been more than 40 per cent short. There were times during the past year when the men were very restless. It is problematical as to just how long it would have been possible to hold the remaining 60 per cent with two increases in wages, aggregating four cents per hour. The prevailing rate at the present is considerable under that paid by contractors, and a number of our men left to go to work for contractors, but returned. The only explanation to be given for this is the attraction of permanent employment, which probably means in the end that the laborer working under this system receives more in his pay envelope at the end of the month than the laborer who works for contractors and others at a higher rate, but is not assured of permanent employment.

In this part of the country the labor situation is probably no different from that in other manufacturing districts where exorbitant rates are paid to unskilled laborers, and this undoubtedly has the effect of impressing on the ordinary laborer more forcibly than ever, the fact that if he became just a little bit more skilled he would be able to command higher wages.

It is contended that this experience has proven beyond a doubt that the solution of the track work problem lies in the permanency of the section force. The line and surface on the railroad has been steadily improving. The efficiency, of course, is the outgrowth of experience, and everything that tends to efficiency naturally reduces expenses.

EXPERIENCE ON THE FRISCO

By P. H. HAMILTON,

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At the beginning of the fiscal year 1914 the Frisco adopted the plan of maintaining a permanent standard minimum section force of four men for main-line sections and three men for branch-line sections. This insures work to three or four men on each section the year around. During certain seasons this force is increased as required. This arrangement has proved successful and has been a source of encouragement to the track forces. Previous to 1914, season employment of section forces and the system of monthly allowances was practiced, and a great deal of money was spent in handling inexperienced men and in organizing and disorganizing temporary gangs. Section foremen now understand that their forces will not be reduced below the minimum, and they are insured of permanent employment for their best men.

This plan has not been deviated from since its inauguration, except on three divisions, recently equipped with section motor cars, where the sections have been lengthened to ten and eleven miles and the minimum force allowance increased to eight and six men. Also a shortage of labor in certain localities during the past season has not permitted the foremen to work their minimum forces. However, the permanent employment of certain men has maintained a force where men are in demand at wages considerably higher than paid by the Frisco.

During the past year the shortage of track labor has been felt. This was made more noticeable by the heavy maintenance and improvement program being carried out by the Frisco. The Frisco operates in the agricultural and industrial sections of the South and the Middle West and these industries offer alluring wages to common labor.

The Frisco traverses the great oil-producing districts of Oklahoma and Kansas, and in that territory the shortage of labor during the summer months was acute. Common labor in the oil industries receives from $3.50 to $6 per day—a rate which the railroads cannot meet. It has been impossible to keep gangs filled up to the minimum in this territory, but some foremen have kept a fair force, and it has been necessary to work them on adjoining sections. The I. W. W. and other disturbing influences have been very active in this district, but there has been no strike among the track forces. During the early summer months reported members of the I. W. W., by threats and acts of violence, forced section gangs in the vicinity of Henryetta, Oklahoma, to leave their work.

There has always been a shortage of track labor in the coal, lead and zinc mining districts of Kansas and Missouri, but during the past season it has been more acute. Many of the men who have been continuously employed stayed on, and it has been possible to maintain track in these districts by moving section forces from one section to another on passenger trains or by motor car.

At the time the permanent section forces was authorized, permanent rail and ballast gangs were also organized. These permanent organizations are handled by capable foremen, who receive a high rate of pay. They work year in and year out. An organization of one rail gang and sufficient ballast gangs to keep up with the rail gang is provided for each general superintendent's district. It is the intention to arrange the work, as nearly as possible, to take advantage of the seasons, working in the South in winter, and North during the summer months. During July and August the number of men on these gangs ran low, but the "hobo" fraternity knows of these organizations, and now they are filling with men from the north.

It is the practice to use every labor-saving device possible with these permanent gangs and they are equipped with power rail-laying machines, power rail loaders, power tool grinders, etc. All of the gangs are equipped with motor cars. Sharp tools for the rail gangs are essential to conserving labor, and the tool grinder is very important.

SCIENTIFIC MANAGEMENT IN TRACK WORK

The Baltimore & Ohio and the Pennsylvania Have Standardized Problems and Offer a Bonus for Extra Efforts

SCIENTIFIC MANAGEMENT has been a much abused term in industrial operation during recent years, brought about largely by the failure to apply its principles in a practical manner. As a result it has been brought into bad repute in many quarters in spite of the soundness of its basic principles. Railway men, particularly in the maintenance of way department, have been averse to considering its merits and to giving it a trial, pointing out many conditions peculiar to the work in this department, which are claimed to make it unsuited here. However, two of the largest and most important roads in the country, with conditions ranging from busy four and six track main lines through the mountains to single track prairie branch lines with very light traffic have gone into the plan extensively and with success. It is the purpose of this article to describe the manner in which the system has been installed on the Baltimore & Ohio and the Pennsylvania Railroad and the results which have followed.

THE BALTIMORE & OHIO PLAN

The Baltimore & Ohio is the pioneer in the development of this system which has been limited to the track department on this road up to the present time, and which has been termed the Standard Track Work System. Its progress here dates back to the spring of 1911, when two men were placed on the staff of the general manager to investigate the general plan as applied in other industries, to formulate the details of its application to track work and to develop time studies. Later in the same year the system was installed on the Philadelphia division, extending from Baltimore to Philadelphia. For two years the plan was confined to this division, but in 1913 the details had been worked out sufficiently to warrant its further extension. During this year the system was extended over the entire Chicago division and on the subdivision between Baltimore and Washington. In the next two years the Standard Track Work System was placed in operation on one subdivision on the Newark division. Since that time it has been extended over two subdivisions and on six other divisions, the latest territory to come under this system being the Illinois division of the southwestern lines on which it was installed during the summer of 1916.

At the present time the Standard Track Work System is in force on 26 subdivisions with a total line mileage of 1,316 miles. With the exception of six relatively short sections, two of which are through terminal and industrial districts and one on joint track, the entire line from Philadelphia to Chicago is now being maintained under this system. Likewise, the main line of the South Western system between Parkersburg, W. Va., and St. Louis, with the exception of the Cincinnati terminals and one subdivision in Indiana, is working under the same plan. No extensions have been made during the last year because of a lack of experienced assistant supervisors who could take charge of the administration of this plan on additional subdivisions. However, as soon as this condition changes, it is planned to install the system on the remaining divisions.

THE MAINTENANCE ORGANIZATION

The maintenance of way organization of the Baltimore & Ohio is divisional in character. Two engineers maintenance of way have charge of the roadway and structures on the lines east and west of Parkersburg, W. Va., Wheeling, W. Va., and Chicago Jct., Ohio, reporting to their respective general managers at Baltimore and Cincinnati. A district engineer is assigned to the staff of each of the five general superintendents, reporting through him to the engineer maintenance of way. A division engineer is located on each division, in charge of the supervisors of track, bridges and buildings and water service and reporting through the division superintendent to the district engineer. One or more supervisors of track are located on each division in direct charge of the maintenance of the track on a certain territory.

When installing the standard track work system, no change has been made in this organization except to give each track supervisor an assistant. This assistant re-

1. Deduct detention at end of pay period only, on line provided at bottom
2. Fill in total detention at end of pay period only, in detention column.
3. No detention to be deducted from Patrolling, Unscheduled O. D. and Unscheduled M. of W. Miscellaneous.
4. Total Working Hours to be filled in at bottom of column at end of pay period only, and performance calculated and recorded.
5. Standard Hours for total Patrolling, total Unscheduled O. D. and total Unscheduled M. of W. Miscellaneous to be recorded at bottom of respective columns, at end of pay period only.

Daily Record

Foreman G.L. Arrington

DETAIL OF SCHEDULED WORK (Standard, Form 940 and Supervisors Schedules)

Supervisor's

Date	Leaving	Reaching	Completed	Removing Tie Plates	Renewing Tie Plates	Renewing Ties	Renewing Rail	Cribbing Ballast	Draining Ballast	Unloading Ballast	Applying Track Material	Loading or Unloading Ties	Loading or Unloading Rail	Handling Material	Tightening Bolts		Morning R. of W.	Clean out ditch and culvert											
	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.	St. Ac.
1																												
2																	16 32										21	
13																	23 24											
14		12 10		31 50																								
15		25 24					27 34												7 7									
16		175 214		31 50			27 34										39 56		2 2				200 211					
17		21		5			3										6											
18		175 193		31 45			27 31										39 50		2 2				200 211					
19		43 55																										
20		49 60																										
21							51 58																					
31							29 30																				50 30	
1		381 463					133 142				87 120								5 3								50 50	
2		46					13				18								—								—	
3		381 417					133 130				87 108								5 3								50 50	
4		556 610		31 45			160 161				87 108						39 50		7 5				200 211				50 50	

ports directly to the supervisor and devotes his entire attention to the standard track work system. He has no direct responsibility for the proper performance of work, this being left to the supervisor, but his problem is to measure it accurately.

A large part of the responsibility for the successful administration of this plan rests on the assistant supervisor. He compiles all records, determines the ratios of gang performances to the standards and from this arrives at the amount of bonus earned. Upon instructions from the

WORK ORDER

Section No. 23 G.L. Arrington.

OUTLINE OF WORK	Location of Work: Track	From	To	Time to be Completed
Surface M.T. Low joints.	E.B.	21.4	24.5	350
" " " "	W.B.	22.0	23.0	350
Renew switch ties 1000 lin. ft.	Sdg.	Lowell		140
Dress ballast center ditch 850 ft.	Annapolis dct			75
Clean out ditch subway Lowell				50
Begin work Oct. 18-1917 Surfacing tracks.				

Order No. 15 Oct. 17 1917
W.G. Beall Supervisor

Work Started Hour Date 19
Work Finished 19
Foreman

supervisor, he issues work orders or "dispatches" for the work to be done. Normally, the office work requires about 1½ hr. of the assistant supervisors' time daily. The remainder is spent on the line, the assistant supervisor getting out among his gangs nearly every day. In most cases he spends his time with individual foremen whose reports indicate that their performances are above or below the average, aiding them in improving their output and in removing any difficulties which may be confronting them. He also checks the work done to insure the accuracy of the reports of the foreman, although very little difficulty has been encountered from this source. Work done out of face can be checked accurately, although only a more general check can be secured of "spot" work. In respect to this part of his duties, the assistant supervisor corresponds with a piece work inspector in a shop. To enable them to get over the line many of the assistant supervisors use motor cars assigned to the supervisors.

To enable him to assign the proper units for work to be done, it is necessary that the assistant supervisor have an intimate knowledge of conditions affecting the time required for work on each portion of the line, such as the weight of the rail, the character and the amount of the ballast, etc. It is, therefore, necessary for him to study his track in detail. To aid him in this work, each assistant supervisor is required to make and maintain a complete record of all local conditions in book form. Foremen are then required to locate all work reported by telegraph poles so that it can be identified readily and accurately.

In addition to the assistant supervisor on the line two general inspectors work out of the office of the engineer maintenance of way at Baltimore, checking and standardizing the work of the assistant supervisors. One of these inspectors endeavors to spend 2 or 3 days with each new assistant supervisor as he enters on his duties, breaking him in. These men also check the records of the assistant supervisors to see that schedules are set properly and that other details are handled correctly. These inspectors spend almost their entire time on the field, traveling from one subdivision to another.

PREPARATION OF STANDARD SCHEDULES

Previous to the introduction of the Standard Track Work system it is necessary to determine standard units of performance or schedules on which the actual performances will be rated. It is essential that these units be accurate or the entire plan will be ineffective. The standard performance on the Baltimore & Ohio was taken as the output of a first-class gang working at a speed which could be maintained continuously through the working day, following an approved method of doing the work and consisting of the most economical number of men for the class of work to be done. To determine these units two experienced division engineers familiar with track work were assigned to the making of time studies and they devoted their entire time to this work for several months. They worked separately, spending from two weeks to a month with each of several of the most efficient gangs. They were provided with stop watches and recorded not only the time required for complete performances, but also for the various elements entering into them. In this way it was possible to compare the efficiency of different methods and to ascertain the best method. Standard or 100 per cent performances can then be established for these approved methods. In this way 42 schedules have been prepared up to the present time, covering all of the more important and some of the minor problems of track work. These studies are

Section Detention Allowance 10 %

Track Work Performance—Section No. 23

Month of October 1917

Schedules →

Total Standard Time	Detail of Unscheduled O. D. Work: Light Slag Tamps. Shimming Out for Line	Total Unscheduled O. D. Work	Detail of Unscheduled M. of W. Miscellaneous Work: Pat out Clean Tracks Straighten Tracks Adjusting Frogs Switches Guard Rails Bolting Frogs Switches Guard Rails Adjusting Expansion Joints	Total Unscheduled M. of W. Miscellaneous Work	Total Unscheduled Time	Penalties	Total Time Allowed	Detention	Unscheduled Time	Total Pay Roll	Recorded Time	Date	Remarks
Hr. Mn.	Hr. Mn.	Hr. Mn.	Hr. Mn.	Hr. Mn.	Hr. Mn.	Hr. Mn.	Hr. Mn.						
16 32	1			1	12		5 16	50		50	32	1	
23 45	1			4	4		5 23	55		55	24	5	
43 60	1			4	4		5 43	70	–	–	70	60	15
54 70	1			4	4		5 54	80	–	–	80	70	16
414 567	27	18 27	24 56	20 3 15	80 118	49 73	414 785	35	–	785	546	Total	
35													
474 532	27	18 27			80 118	49 73	621 785	83	35	–	785	546	Day
43 55	1		4	5	9		5 43	70	–	–	70	55	16
49 60	1		4		4		5 49	80	–	–	70	60	17
51 58	13	13	4		4		5 51	80	–	–	80	58	18
79 60	1		4		4		5 79	70	–	–	70	60	21
656 781	40 70	73 110	56	5	41 61	52 78	652 1030		75		1030	781	Total
73													
656 708		73 110			41 61	52 78	822 1030	86	73		1030	781	Day
1130 1240		91 137			121 179	101 151	443 1815	85	108		1815	1327	Total

being extended from time to time as the occasion warrants and it is expected that ultimately almost all of the work done by track forces will be covered by schedules. This, however, does not include emergency repairs, for which it is difficult to prepare standard schedules.

In comparing the time studies made with different gangs previous to the determination of the schedules, it was found that there was a surprising uniformity in the performances on different territories and that the effect of local conditions was far less than had been supposed. As a result the same schedules prevail on all parts of the road for the same classes of work, subject to very minor adjustments. Likewise, there has been little occasion to revise the schedules from the figures originally established, either to eliminate excessive bonus or the inability to earn any, and they now stand practically as issued originally.

In applying the standard schedules to actual performances, certain factors which tend to decrease the output and which are beyond the control of the foremen, must be allowed for. Among these are the time lost because of passing trains and that required to go to and from work, depending on the location of the section house with reference to the section limits. To compensate for these and other similar factors each section is given an arbitrary detention allowance which is based on its local conditions and which is applied to all work done on that section. In arriving at this detention factor, two men studied the train sheets in the despatcher's office. They also studied the train movements on the ground, noted the location of the section headquarters, etc. While difficulty was encountered in some instances in arriving at a proper detention factor and some revision was necessary, this trouble has been practically eliminated now. The detention factor has been found to average about 10 per cent on line sections, while it is somewhat higher in yards where it reaches 25 per cent in some instances. In administration, the actual time distributed to each item of work is reduced by the detention factor before the ratio between the standard schedule and the actual performance is arrived at.

pected to profit by his experience and to be more accurate in his estimate the next time. The general inspectors assist the supervisors in arriving at correct figures for unscheduled work. They compare the schedules set by the supervisors on different subdivisions, check unusually high performances and follow up any discrepancies by personal conversations with the supervisors and assistant supervisors on the ground.

All work unscheduled, except that which, because of its nature, cannot be successfully scheduled and is classed

THE BALTIMORE AND OHIO RAILROAD COMPANY
MAINTENANCE OF WAY DEPARTMENT

DAILY REPORT OF LABOR { Section / Et. Gang } No. 23, Oct. 26 1917

NAME OF EMPLOYE	BRASS CHECK	OCCUPATION	RATE OF PAY	HOURS	STATUS
	5621	Foreman		10	
	5661	L.Laborer		10	
	5670	Trackman		10	
	5663	"		10	
	5675	"		10	
	5669	"		10	
	5665	"		10	
	5674	"		10	
			TOTAL HOURS	80	

KIND OF WORK DONE	AMOUNT OF WORK DONE	TRACK MAIN	TRACK SIDE
Patrolling track 6 miles		5	5-0
Light station lamps		1	1-0
Cleaning tracks around Laurel		4	4-0
Light switch lamps.		12	12-0
Surface Main track, E.B. 48 Rails, 276 Tie Ends Tamped, Low joints, Quarters and Centers.		58	54-58
51 Std. TOTAL HOURS		80	

G.L. Arrington Foreman

as "ungraded," is given a rating of 67 per cent in the computation of bonus. As this tends to pull down the average of the other work, it provides an incentive for the scheduling of all work practicable. As a further incentive to the supervisor to actually plan and direct the work he is paid a bonus of 50 cents for each per cent over 80 in the percentage of work scheduled each half month if the per cent of efficiency of the subdivision is over 80. The latter provision acts as a curb on any

Baltimore Division Supervisor W.G. Beall
Sub-Division No. 1 Asst. Supervisor H.L. Exley

Monthly Record

Sect. No.	2 Lining			3 Surfacing			4 Gauging			5 Renewing Cross Ties			6 Renewing Switch Ties			7 Reapacing Ties			8 Renewing Rail			9 Cleaning Ballast			10 Dressing Ballast			11 Applying Other Track Material			12 Handling Material			13 Tightening Bolts			Hand "car travel		
	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%	Stand. Hrs.	Actual Hrs.	%
1				412	492	84	5	7	71	173	194	89	91	101	90				18	24	75	4	9	44							180	208	87						
1a				247	310	80	14	26	54	69	77	90							6	8	75										21	34	62	33	60	55			
2				492	548	89	37	32	115	68	77	89	7	8	88				3	17	23													39	51	77			
3				604	788	76	108	197	55	120	109	110	60	93	64				54	99	55										130	174	75						
25				846	897	94													3	4	75							56	54	104	215	216	99	4	5	80			
26				160	192	83	9	9	100	24	22	108	216	354	61										28	33	85	1	4	25	38	37	103						
27				214	243	88																																
Total sections				9017	8330	86	294	428	69	880	1079	81	1160	1500	77	32	77	119	193	370	52	4	9	44	772	898	86	520	582	89	893	1166	76	250	290	86	27	38	71

Some of the work done by track forces is more or less special and local in character and difficult to schedule so as to properly apply in all sections of a large railroad. For such work the supervisors are encouraged to establish schedules of their own, based on their best judgment as to the time required and their knowledge of local conditions. While a supervisor may make a mistake in the schedule he fixes, the road insists that the schedule specified be adhered to until that particular job is completed. Unless the error is an obvious one in judgment, no criticism results the first time a problem of this character is encountered, but the supervisor is extendency to schedule work promiscuously, without regard to the efficiency of the work. As a result of these measures the percentage of work handled under schedules has increased steadily until now from 75 per cent to 90 per cent of all work done is ordinarily scheduled on the different subdivisions. This percentage shows an increase of 15 to 18 per cent since the system was started. Individual subdivisions have shown a maximum of scheduled to total work of 96 per cent for single months. In general between 50 per cent and 60 per cent of the work not covered by standard schedules is now being scheduled by the supervisors themselves.

THE WORK IS PLANNED FOR THE FOREMAN

One of the essentials of efficiency in the conduct of any work is the systematic organization of that work to eliminate as far as possible lost motion resulting from the unnecessary movement of gangs from place to place. The Baltimore & Ohio has endeavored to meet this principle by the adoption of a planning sheet, designed to cover the work for a season in the renewal of ties, the laying of rail, cleaning ballast, etc. One of these sheets is prepared for each section at the beginning of the calendar year, indicating the program of work to be followed through the season.

The program of work for the season is determined at a conference between the division engineer, supervisor and the assistant supervisor shortly after the beginning of the calendar year. The scheduling of work for each month is done by the supervisor with the help of the assistant supervisor, following the general plan of the season's work. The assistant supervisor at the end of each month colors these planning sheets to show (1) the work completed the past month and (2) the work scheduled for the current month. After the work is scheduled for the month the supervisor issues a work order or despatch to the foreman for a portion of the work scheduled which he can complete in two weeks. This order indicates to the foreman the amount and character of the work to be done, its location and the time estimated to do it. Despatches are regularly issued each two weeks and may contain in addition to work covered by the planning sheets such other work which supervisor may schedule.

The despatch is made out in duplicate, the original going to the foreman and the carbon being retained for file in the office of the supervisor. As the work is completed the despatch is returned to the supervisor's office for record and filing. Each order is good only for two weeks and must be returned to the office at the end of that time, even if the work is incomplete. If it is desired that that job be continued a new order is then issued. To enable a foreman to concentrate on his work, the number of work orders is held to the minimum. In so far as possible, not more than two despatches are in the hands of a foreman at a time, although this is not fixed arbitrarily. The foreman is given a work order for all work done, except such work which of its nature cannot be scheduled successfully, e. g., patrolling, etc., although failure to receive such an order does not relieve him of responsibility for the making of unforeseen or emergency repairs.

RECORDS ARE AN IMPORTANT FEATURE

A very important feature of the Standard Track Work System is the records. Not only do they form the basis for the distribution of charges to the proper accounts, but they are also the basis for comparisons of performance with the standard schedules from which the bonus is determined. The initial record is the daily report of labor, which is made out in duplicate by each section foreman, who sends the original to the division accountant for the distribution of charges, the preparation of payrolls, etc., and the copy to the assistant supervisor for use in determining the relative performances. This record shows the numbers and identity of the men working and the distribution of the various items of work.

These daily reports are entered on a daily record of track work performance in the supervisor's office, one sheet being provided for each section with spaces for an entire month and for summation twice a month. The time spent on work for which standard schedules are provided and on work for which the supervisor provided schedules, is recorded together with the scheduled time. Other columns are provided for all unscheduled work. At the close of each half monthly period, the time actually spent on each class of work is totaled, the detention is deducted and standard time divided by the corrected total for that class and amount of work to determine the percentage of efficiency.

At the close of each month the assistant supervisor makes up a further report covering all sections and summarizing the data on the daily record of track work performance. This report shows the per cent efficiency of each gang for all work and the average for the entire subdivision. This report is sent to the division engineer. With it the assistant supervisor sends another report showing the amount of each class of work scheduled by the supervisors and the percentage made on this work on his subdivision. A third report shows in detail the items of all unscheduled work. From these latter two reports it is possible to check the accuracy of all schedules set by the supervisor and to observe whether any of the unscheduled work can be scheduled.

As soon as the efficiency of the several gangs is determined each supervisor prepares a bulletin, which is sent to all foremen, giving the standing and efficiency of each gang for the month. Comparisons are made between the performances of different gangs on various classes of work and an effort is made to encourage greater exertion. Opportunity is taken here to call attention to particularly good performances and to comment on means of raising the standards. Copies of these bulletins are sent to the division engineer.

The division engineer consolidates the reports of his supervisors into a single report which he sends to the engineer maintenance of way at Baltimore with a copy to the district engineer and on the western lines to the engineer maintenance of way at Cincinnati. The engineer maintenance of way at Baltimore in turn makes a consolidated report to the general manager, giving the

Track Work Efficiency

Percent of Working Hours Scheduled 83 Percent of Total Hours Dispatched 75 Sheet No. 10 Month of October 1917

15		16		17 Scheduled Form 948			18 Scheduled Other Departments			19 Misc. Supervisors Schedules			20 Total Scheduled Hours			21 Patrolling			22 Unscheduled M. of W. Miscellaneous			23 Unscheduled Form 948			24 Unscheduled Other Departments			25 Total Working Hours (Except Ungraded)			26	27	28	29	30	31 FOREMAN AND HEADQUARTERS
Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%	Sched. Hrs.	Actual Hrs.	%						
			195	236	83	1451	1764	83	139	171	81	2668	3208	83	104	155	67	216	330	67				98	145	67	3086	3838	81	185	4023	210	4233	1	A Tallara Bayview
						189	190	105	324	400	81	913	1105	83				91	135	"							1004	1240	81	90	1330		1330	1a	T. Lannon "
									345	336	103	991	1065	94	104	155	67	168	251	"							1263	1471	86	87	1558		1558	2	J. Walters, Gay St
			162	196	83	215	250	86	589	692	85	2224	2724	74	97	145	"	594	888	"				20	30	67	2768	3787	73	337	4124		4124	3	A. Miles, Huntingdon Ave
									207	258	80	1331	1434	93	80	124	67	6	7	67				27	39	67	1444	1604	90	122	1726	24	1750	25	J.H. Noy Mt. Royal
									344		90	1820	1032	80	100	150	"	280	418	"				13	19	"	1213	1619	75	72	1691	231	1922	26	J.T. Scott Bettsville
												214	243	88	50	75	"	3	5	"				10	14	"	277	337	82	23	360		360	27	C.D. Hall Relay
			357	432	83	1865	2206	89	5885	7086	83	12095	25489	83	1328	1992	"	2753	4117	"				524	774	"	29143	32312	80	2380	34752	6443	41195	Total	Sections

RECORDS ARE AN IMPORTANT FEATURE

A very important feature of the Standard Track Work System is the records. Not only do they form the basis for the distribution of charges to the proper accounts, but they are also the basis for comparisons

bonus earned and other data showing the performance during the month. Copies of this report are sent to all district and division engineers so they can learn what the other divisions are doing.

The two general inspectors prepare brief analyses of the monthly reports of the division engineers for the assistance of the district engineers. In these analyses they point out features which should be improved and make constructive suggestions for the raising of the standards throughout. These inspectors also meet at intervals varying from two weeks to a month and compare notes on their observations of conditions which they have found on the line since their last meeting. They then make a joint report on these conditions and criticisms to the engineer maintenance of way at Baltimore, copies of which are sent to the engineer maintenance of way at Cincinnati and to all district and division engineers. In this way the ideas worked out on one subdivision are brought to the attention of all and practices are harmonized.

THE BONUS FEATURE

As described so far the plan is concerned only with the standardization of track work. However, while the efficiency can be increased materially by this action, there is a limit beyond which improvement cannot be expected except through an appeal to individual effort. In the plan adopted on the Baltimore & Ohio this appeal is made through the payment of a bonus for increased effort, the amount depending on the extent to which the output is raised. In this way the employees share with the road in the benefits of the added output.

In the plan adopted, the regular wage is guaranteed the men in all cases. The gang is the unit for the computation of the bonus and all men receive the same percentage. The bonus is computed in per cent of the wages earned. No bonus is paid for performances equivalent to 67 per cent of the standard schedules or less. Above this figure the bonus increases as the efficiency of the gang rises until a premium of $0.20 is paid per dollar of wage earned for 100 per cent performance. Beyond that point the bonus increases 1 per cent for each per cent increase in efficiency. As a check on the plan the assistant supervisor, who is charged with the actual administration of the system, receives no bonus and he has no personal incentive to increase any figures. The percentage of bonus for the different performances is as follows:

Efficiency Per Cent	Bonus per $1.00 Wages	Efficiency Per Cent	Bonus per $1.00 Wages	Efficiency Per Cent	Bonus per $1.00 Wages
67	.0001	82	.0433	96	.1557
68	.0004	83	.0492	97	.1662
69	.0011	84	.0553	98	.1770
70	.0022	85	.0617	99	.1881
71	.0037	86	.0684	100	.20
72	.0055	87	.0756	101	.21
73	.0076	87.5	.0794	102	.22
74	.0102	88	.0832	103	.23
75	.0131	89	.0911	105	.25
76	.0164	90	.0991	110	.30
77	.0199	91	.1074	120	.40
78	.0238	92	.1162	130	.50
79	.0280	93	.1256	135	.55
80	.0327	94	.1352	140	.60
81	.0378	95	.1453		

It has been the experience that as the Standard Track Work System has been installed on different subdivisions, the gangs at first earn very little bonus. However, as they become interested in the plan and understand the opportunity to increase their earnings their efforts increase and their efficiency rises. After the plan has become thoroughly established on a subdivision it is found that about 90 per cent of the gangs earn some bonus. In general the performances run from 80 to 85 per cent, although in some instances the efficiency runs considerably higher. In July, 1917, one gang on the Cumberland division made 103 per cent, the foreman earning $17.40 bonus. In the same month the highest rating on the Connellsville division was 98 per cent, which earned $12.70 for the foremen, while the highest rating on the Pittsburgh division (95 per cent) earned $13.10 for the foreman. It has also been found that once a gang becomes accustomed to the bonus system, its performance does not vary greatly from month to month, the tendency, if any, being slightly upward. Also the gangs usually show about the same relative efficiency in the different classes of work to which they are ordinarily assigned in routine section maintenance. As would be expected, the highest performances have in general been secured on the Cumberland and other divisions where native labor is employed most generally. It has also been observed that the foremen earning the highest bonuses are in general those who also have the best track.

As an indication of the magnitude of the bonus payments, the average monthly expenditure last year was about $15,000, or about 5 per cent of the total payroll of the forces concerned. A comparison of the bonuses earned on 185 sections in July, 1917, showed that—

54	foremen	increased	their	wages	$0 to $ 2
60	"	"	"	"	2 to 5
36	"	"	"	"	5 to 7
22	"	"	"	"	7 to 10
13	"	"	"	"	over 10

On the same sections the hourly rate of laborers' wages was increased as follows:

51	sections	increased	wages	0 c to ½c
42	"	"	"	½c to 1 c
31	"	"	"	1 c to 1½c
28	"	"	"	1½c to 2 c
10	"	"	"	2 c to 2½c
16	"	"	"	2½c to 3 c
7	"	"	"	over 3c

THE PENNSYLVANIA PLAN

The Pennsylvania has also adopted the Standard Track Work System, and although it did not make its first installation until in September, 1916, it now has the plan in effect on a greater mileage than the Baltimore & Ohio. Originally it was tried out as an experiment on one supervisor's division, and was introduced simply as a change in accounting, no mention being made of a bonus at that time. The experiment was continued for a period of three months, after which it was decided to extend the system to other subdivisions and to add the bonus feature. The first bonus was paid in November, 1916. Since that time the Standard Track Work System has been put in operation on *all* of the 5,400 miles of lines of the Pennsylvania east of Pittsburgh. The purpose of the system is to increase the efficiency of the maintenance organization through the standardization of methods for doing each item of work and the offering of a money bonus as an incentive to those who will increase the output of work beyond an amount set by competent authorities, after careful investigations, as the average production of men not working under the stimulus of additional payments.

The Pennsylvania Railroad has the most highly developed organization of any large railroad in this country. It also provides more trained supervision than most roads. This is particularly true of the maintenance of way department from which nearly all of the operating and executive officers are drawn.

The organization is strictly divisional in character. The engineer maintenance of way is a staff officer reporting to the general manager and in charge of all standards and practices in the maintenance of way department. On each of the six grand divisions are principal assistant engineers reporting through the general superintendents to the engineering maintenance of way. A division engineer is likewise located on 21 of the 23 divisions in direct charge of the maintenance of track and structures on his division. Reporting directly to him are master carpenters and supervisors of track. Each track supervisor has an assistant who concentrates his attention on the work in the field. He also has one or more clerks who handle all routine office work.

With the installation of the Standard Track Work System, no change was made in the organization. The supervisor is responsible for the administration of the plan on his subdivision, but the details of its operation in the field are left to the assistant supervisor. All accounting, preparation of records and computation of the bonus is handled by the office employees. This differs from the plan on the Baltimore & Ohio, where all office and field work in connection with the Standard Track Work System is handled directly by the assistant supervisor.

In addition to the local organization a supervisor and two assistants attached to the staff of the assistant general manager are devoting their time to the general installation of this system on the different subdivisions and to general supervision of its administration.

UNIT PERFORMANCES BASED ON STUDIES

The methods upon which the standard performances or 100 per cent efficiency is directly dependent were arrived at from detailed time studies of each item of work. The first experiments were made with a section gang organized in its regular manner and following its regular method of working. The output of each item of work and the time consumed in the operations were observed and noted. In many instances these studies disclosed poor planning. For instance, a gang of 10 men installing tie plates might be organized with 6 men pulling spikes ahead of 4 men who were placing the plates. The time studies disclosed the fact that the 6 men could do enough work in 5 min. to keep the 4 men busy for 15 min. and indicated the advisability of reapportioning the work. These experiments were followed with others made with the gang reorganized and following suggested methods of working until the most satisfactory way of doing each item of work was definitely determined.

A picked gang was then recruited and set to work, following the methods adopted as standard. At first this gang worked without incentive and the output and the time consumed in each operation was noted. A day's work, based on prior observations, was then set for this gang and the men were told to go to it and that they might quit when through. If, for instance, the gang completed the day's work in seven hours the men were allowed to go home. In these experiments it frequently happened that the willingness of the men resulted in too great exertion, and some of them would not report for work on the succeeding day, indicating that the pace set in the trial could not be maintained safely. This angle of the problem was carefully considered and 100 per cent efficiency or standard performance, which may be defined as the output of an experienced gang when working under proper supervision and following standard methods, at a pace that can be maintained without injury to the men, was fixed between the output of the gang working without incentive and what they did when allowed to go home on the completion of a specified day's work.

These studies were made in as much detail as possible. Each unit of work was divided into items and each item was studied under all the different conditions under which the unit of work might be done. For instance, considering the surface of track as a unit of work, detailed studies were made of all the items making up the unit, such as cribbing out, tamping 6 in. from the rail, tamping 14 in. from the rail, holding up ties on bars and on jacks, dressing ballast, supervision and sighting, etc. Separate studies were made of each item with the unit of work being done in stone ballast, cinder, slag, gravel, etc. The other track work units were studied in the same detail and, in addition to determining just how long each item of each unit of work should take when done in the proper manner, all unnecessary moves were eliminated from the methods adopted as standard practice. Also as a result of these detailed studies it is possible for the time to be kept in detail, which is essential to the successful working of the system.

There is, of course, a limit beyond which the subdivision of work units for payroll purposes defeats the object of the system, which is efficiency. In pulling spikes it might be desirable from a theoretical viewpoint to divide the work unit into items and differentiate between soft and hard wood ties, but the increased supervision and accounting made necessary if each kind of tie encountered were noted would make such a refinement impractical, even though it is harder work to pull spikes from oak ties than from pine ties. It is the intention ultimately to schedule every item of work in which track men might engage at the present time; however, only maintenance of way track work has been scheduled. Until such time as all the work is scheduled the supervisors are expected to prepare schedules for work other than track work, such as digging ditches, unloading cinders, helping other departments, etc., and submit them for study and approval. These schedules are to be based on past experience and detailed observations made during the progress of the particular work.

THE DETENTION FACTOR

As in all maintenance of way track work an appreciable part of each day is unavailable time for actual work, the equitable application of the standard track work system depends largely on the determination of a detention factor that will, when applied to the computation of percentage efficiency, equalize, as nearly as possible, the working conditions on all foremen's sections. This factor is based on the proportion of each day that is lost time and when determined for a particular section is applied as a percentage of the total time of the gang.

In keeping the time of each gang the time schedules are reduced to a unit performance of 10 hours and the time is kept from the time of leaving the tool house in the morning until the return at night, each man being credited with 10 hours' time. The time lost in getting to and from work and the time unavailable for work are so affected by local conditions that a flat allowance for detention cannot be made equitably. On sections including only main line tracks the time lost from actual work will vary with the number of train movements. On other sections, main tracks, yard tracks, ladder track, and other physical characteristics of the line all making for detention may be encountered. On such sections the unavailable time for working varies with the location in which the foreman is working on a particular day. To cover all these different situations arising from the varying conditions time studies were made on each foreman's

section to determine how much of each day's time was unavailable for work. On the first sections cited a single detention factor was arrived at for each section, but the factor varies with the amount of unavailable time. In the second instance the different conditions obtaining on a section were considered and from the time studies made different factors of detention were arrived at for the different locations on the section.

FORMS AND REPORTS

In the execution of the system certain forms are essential which are similar in a general way to those used on the Baltimore & Ohio and described above. In order that the supervisor may plan the work of each section in advance, a sheet called the Supervisor's Planning Sheet is filled out for each section on the first of each year. This shows the rail, tie and tie plate allotments for each mile of track, the amount and location of track to be raised, ditching and all other work of any magnitude which the supervisors wish to include in the season's work. From these planning sheets the supervisor despatches the work through the medium of work orders which outlines to the foremen the work to be done and the time estimated to be consumed in doing it. These orders are issued in duplicate, one copy being retained at the issuing office for record. The original is returned by the foreman on the completion of the work called for at the end of 30 days from the date of issue if the work is still incomplete. With the work finished the foreman marks on the order the time of beginning and completing. If the work is not completed before the end of the 30 days it is so marked by the foreman and the work order is returned to the supervisor. A new order covering the incompleted portions of the work is then issued. In addition to its use in despatching the work the planning sheet is used as a record in which the tie renewals and other scheduled work completed in the preceding month are recorded at the beginning of each month as well as the renewals scheduled for the ensuing month.

As the system is installed on a section the foreman and his assistant are given complete instructions in book form regarding what they are to report in the foremen's daily report of time and work done. This report is used by the foreman to show the time of the men for payroll purposes and the location, class and quantity of work done and by the supervisor in making up the supervisor's record of work done, which is a complete record of the performance of an individual gang for a month used in computing the percentage of efficiency of the gangs. In the book of instructions three points are emphasized as essential in the making of this report. These are: How Much, How Long, and What Kind. By "How Much" is meant the number of ties or feet of track, etc.; by "How Long," the number of hours of labor and the supervision required to do the work, and by "What Kind," the condition under which the work was done, that is, the kind of ballast, weight of rail, type of rail splices, tie plates (or no tie plates), etc. In other words, this report required the conditions under which the work was done, together with the location of the work on which the detention factor depends, all of which are necessary in making computations for the percentage efficiency of the gang. For the purpose of giving definite credit for all the work done in tamping ties a tie is considered as made up of four parts, one part outside and one inside of each rail. A tie tamped at one part from one side counts as one part single tamped; a tie tamped at one part from both sides counts as one part double tamped, etc. This operation is further divided for payroll purposes into tamping 6 in. from the rail and 14 in. from the rail, but this information is not required to be shown on the foreman's report as the distinction is made by the supervisor from his knowledge of the practice on his division. Reporting thus in detail minimizes the possibility of improper application of the standards whch have been set and the consequent loss either to the company or the men.

The supervisor's record of work done is compiled from the daily reports by computing the actual and standard times for each item of work. The actual time is the time reported by the foreman as hours of labor directly on the work plus the hours by monthly men less the percentage of detention applicable to the particular section in question. The standard time is the time which the job would have taken if done at the rate set forth in the predetermined schedules. In arriving at the percentage efficiency for the day's work only scheduled work is considered.

At the end of the month the total of all columns of the supervisor's record of work done are transferred to the Monthly Report of Labor Performance. On this report one line represents the performance of one gang for the month and the percentage of efficiency is computed for each item of work by dividing the total standard hours by the actual hours.

THE APPLICATION OF THE BONUS FEATURE

As the bonus is paid as an incentive to the men to increase the output a minimum must be fixed below which no additional payments will be made. This has been set at 67 per cent. The regular rate for the actual time worked is paid regardless of whether the efficiency of the gang is above or below this 67 per cent.

The bonus is a percentage of the wages earned at the basic rate and the amount of bonus paid to each man is based upon the efficiency of his gang. For instance, a man earns $45.40 in his regular monthly work. The efficiency of the gang, however, is such that the bonus percentage will give him an increase of 10 per cent of the total wages for the month and the amount of bonus earned is $4.55, making the total amount earned $49.95.

Analyzing the bonus feature, it is apparent that with the proper supervision to prevent the improper application of the standards which have been made it is to the advantage of the company as well as the men to have the efficiency of a gang run as high as possible, and there should be no need to curb the amount of bonus paid to any gang. With a gang working at a low efficiency the guaranteed rate makes the unit prices for a day's work run high, while as the efficiency rises these unit prices decrease. This is one of the principal advantages of this system over the piece work system, as the men need not fear a change in rate through increased output and the company knows that the greater the output the less the unit cost will be.

RESULTS

In discussing the results of any system of handling track labor at the present time, the most important consideration is the effect in securing and holding labor. When first installed on the Philadelphia and Baltimore divisions of the Baltimore & Ohio, it took a considerable time to overcome the prejudice among the men and the division officers as well, but this has now disappeared and interest has been stimulated almost universally. After the men have once satisfied themselves of their ability to earn a bonus they endeavor to secure it each month. This incentive has been found to exist among Greeks, Austrians and most Italians, as well as among the native employees.

In normal times the labor turnover on the Pennsylvania ranges from 15 days to two months, according to the location. Over the system the average is about 30 days. On divisions where the system has been in operation for any length of time the turnover has been reduced materially as a result of its establishment.

The close supervision which is necessary in carrying out such a plan as outlined above is one of its chief advantages. Through his close touch with the work a supervisor will detect abuses of the system and may apply a remedy before much harm is done. He may have a gang of 12 men, six of whom are rying to reap the benefits of the system while the indifference of the other six prevents the gang from maintaining the necessary percentage of efficiency to share in any bonus. If the six indifferent men do not respond to the supervisors' explanations of the benefits, he may divide the gang and it may be possible at times to combine the good men of one gang with the good men of another, thus making one good gang and one poor gang instead of two poor gangs. After the men have come to understand the system and its benefits the gangs rid themselves of undesirables.

In addition to its other benefits it has been found that the system, through the bonus that may be earned, acts as an incentive to foremen to get the work done in spite of the handicaps of short-handed gangs, and instances have occurred where a foreman with only a track walker to assist him has done such work as spotting in ties and renewing switch timbers and was only prevented from attempting more difficult work by orders from his superior officers.

It is often urged against such a system that the results will be to increase the quantity of work at the expense of quality. With proper supervision the contrary has proven true on the Pennsylvania as evidenced by the results of the 1917 track inspection when the first prize was awarded to the supervisor's section first to use this system and the second prize to a division where the system had been in effect nearly a year.

The increased wages which the men have been able to earn through the bonus have helped to hold them until the present abnormal conditions arose. With munition factories and other concerns paying wages twice as much and more than the roads, it is too much to expect that a bonus of perhaps 5 to 10 per cent will hold the men in such territories, the Baltimore & Ohio has shared the general demoralization of its track forces during the past season. However, even under these adverse conditions it has had its effect in holding some men. The installation of this system in the Pittsburgh division enabled the road to hold a number of men who were on the point of leaving, but who found that they could increase their earnings through this system sufficiently to justify them in remaining with the road. In the farming communities where the competition has been less severe, the bonus system has held men more generally. In such territories the present efficiency has been maintained and in some instances raised during the past season, although it has been brought down in the industrial territories by the general demoralization of forces and the introduction of new and inexperienced men. It is the consensus of opinion that the plan could not now be abolished on those divisions on which it is now in force without serious labor trouble unless the men were given an increase in pay equivalent to the bonus they are now receiving. In this event the benefit to the company would be largely if not entirely lost.

Another important advantage of the standard track work system is the opportunity which it affords for the determination of the relative efficiency of different gangs. In numerous instances this system has shown certain gangs considerably more efficient than others when the reverse had previously been considered true. By furnishing an accurate measure of the performance of each gang this method brings out the inefficiency of poor gangs so glaringly that it cannot be ignored.

An interesting development of the bonus system has arisen from the practice of computing the earnings on the performance of the gang as a unit. When the men have realized the manner in which their earnings are determined they have adopted their own measures to rid their gangs of incompetent men in order that the performance of the gang should not suffer. Where argument did not effect an improvement the men have frequently called the matter to the attention of their foremen and in some instances have adopted more drastic measures. The system has also been found to lead the foremen of small gangs to participate more actively in the work of the gang and thereby to increase the output of work for the gang.

While at first thought it might appear that the clerical duties of the foremen have been increased greatly under this plan, such is not the case except to the extent that greater accuracy and a somewhat more detailed distribution of time and materials are required. Relatively little trouble has been encountered in getting the foremen into the new routine, while the effects of the increased accuracy of their records are reflected all through the accounts and furnish more reliable cost data.

The system of planning and despatching work requires more intensive study and supervision of the actual performances of the work than was otherwise necessary. The supervisor and the assistant supervisor find it necessary to study the detailed work of the gangs continuously in order that they may establish schedules and determine the grades intelligently. This close supervision cannot help but be of benefit to the efficiency with which the work is conducted, particularly when considering the fact that the maintenance of way department suffers from a lack of adequate trained supervision to-day. An indirect but important result of this system also arises from the opportunity which it gives for the training of the assistant supervisors in the details of track work which information is highly valuable to them when they are promoted into positions of greater responsibility in the maintenance of way department.

In the administration of the standard track work system the important problems are (1) to get the supervisors and the assistant supervisors to plan and despatch their work properly; (2) to get the assistant supervisor sufficiently familiar with the local conditions on his territory to enable him to rate performances of his gangs accurately; (3) to get the assistant supervisor out among his foremen as much as possible to explain to them the correct way to prepare their reports and to check the units of work done to see that they are as reported; (4) for the assistant supervisor to keep up his grading work and not to allow it to accumulate.

In conclusion, the six years' experience of the Baltimore & Ohio with this plan has led this road to consider it as thoroughly practical. It is planned to extend it gradually as assistant supervisors can be trained to take over additional subdivisions until the entire system is brought under this plan. While it is limited to track work at present, some consideration has also been given to its extension to cover bridge, and building, and signal work, although nothing has yet been done in these directions.

GENERAL NEWS DEPARTMENT

The Railway Age is the new name of the Railway Age Gazette, effective with the issue of January 4, 1918. The Railway Age Gazette was formed by the consolidation of the Railway Age and the Railroad Gazette in 1908. The new name has the advantage of brevity, while it is equally distinctive with the old one.

The fourteenth annual meeting of the American Wood Preservers' Association was held at the Hotel Sherman, Chicago, on January 22-24, inclusive. President John Foley, forester of the Pennsylvania Railroad, presided. Special attention was given to discussions of the influence of the war conditions on the supply of labor and materials used in this industry. A detailed report of this convention will appear in next month's issue.

A statement given out at Washington on January 19, by Louis F. Post, assistant secretary of the Department of Labor, criticized the present agitation for the importation of Chinese and Mexican labor for railroad maintenance, agriculture and other unskilled work as "unnecessary and prejudicial." All requirements for common labor, he declared, can be met by the proper distribution of the domestic supply and by the use of American citizens from Porto Rico and the Virgin Islands. The Department of Labor is now arranging to bring into the country approximately 110,000 common laborers from these two territories, 50,000 of this number to be transported as soon as ships are available. When not in railway service these laborers could be used in agricultural work, thereby supplying the demand for this class of labor.

The American Railway Engineering Association is proceeding with its plans for its annual convention, which will be held at Chicago on March 19 to 21, inclusive. Reports will be presented from the standing and special committees. In addition a large part of the session on Wednesday will be devoted to the consideration of the problems with which the maintenance of way department is now confronted in the handling of labor. It is expected that the report of the Committee on Economics of Railway Labor, discussing methods of securing men and of feeding and housing them, will be presented on that day. Letters have been sent out to a selected list of about 100 members of the Association asking them to prepare and submit descriptions of devices and methods for the conservation of labor which have come to their attention. The annual dinner will be held as usual on Wednesday evening and will be in the nature of a war dinner. It is expected that two prominent railway men will speak on the railway situation at that time.

The government has spent about $9,000,000 and the carriers $16,600,000 on the valuation work from the passage of the valuation act on March 1, 1913, to June 30, 1917. According to a statement prepared by H. C. Phillips, general secretary of the Presidents' Conference Committee for the Federal Valuation of the Railroads, dated December 31, 1917, information is presented to the effect that the Committee had covered over 150,000 miles of main lines with its roadway and track parties up to January 1, 1918. Tentative valuations have been served on 6 carriers with total mileage of 2,120 miles up to the present time. The field and track inspection is now complete on 153 roads with a total mileage of 61,333 miles; it is from 75 per cent to 100 per cent complete on 9 additional roads, including 44,017 miles; it is from 50 per cent to 75 per cent on 9 roads, comprising 36,970 miles, and is started, but less than 50 per cent completed, on 186 roads with a mileage of 186,834 miles. Attention is called to the fact that if the government would concentrate its work on those roads most nearly completed it could bring out a large number of tentative valuations in a short time.

GOVERNMENT CONTROL OF THE RAILROADS

Following the spirit of the brief announcement made in last month's issue the operation of the railroads of the United States is now in the hands of the Government, represented in the person of William G. McAdoo, Director General of Railroads. The President's order placing this plan in effect was issued on December 26, and the Director assumed control two days later, although railway accounts were not placed under the new regime until January 1. Both President Wilson and Director McAdoo have made it plain, in formal proclamations as well as in interviews, that the government management of the railways is purely a war measure, taken to accomplish a unity of administration and simplicity of transportation arrangements not possible under private control. The financial part of the plan of the President to insure compensation to the railways for operation under government management is to guarantee to each railway a net operating income equal to the average which it earned in the three years ending on June 30, 1917, and a bill has been introduced in Congress embodying these considerations.

Beginning with the appointment of a temporary staff of advisers which included John Skelton Williams, controller of currency; Hale Holden, president of the Chicago, Burlington & Quincy; Henry Walters, Chairman of the board of the Atlantic Coast Line; Edward Chambers, vice-president, Atchison, Topeka & Santa Fe; Walker D. Hines, chairman executive committee, Atchison, Topeka & Santa Fe, and A. H. Smith, president of the New York Central, the Director is gradually formulating the organization under which the Government administration will be conducted. The Railroads' War Board, which had been superseded by the Government control, resigned, after serving temporarily in an advisory capacity, although its various administrative departments have been taken over by the new regime.

One of the first definite steps toward an organization was the subdivision of the country into three operating groups, the "Eastern," including roads north of the Ohio and the Potomac rivers and as far west as Chicago, in addition to the Norfolk & Western, the Chesapeake & Ohio and the Virginian; the "Southern," including all roads south of the Ohio and east of the Mississippi, except the three above named; and the "Western," including all roads not included in the first two classes. Regional directors have been placed in immediate charge of each district, these being A. H. Smith, president, New York Central, in the Eastern district; C. H. Markham, president, Illinois Central, in the Southern district, and R. H. Aishton, president, Chicago & North Western, in the Western district. It is also understood that plans are under way to institute a departmental organization under which the various branches of railway administration will be directed by department heads.

The few weeks since this commission was conferred upon Mr. McAdoo have been too short to permit him to make more than a beginning in the problem of unifying the operation of the many hitherto independent railways, definite progress being hampered in part by a succession of severe blizzards that brought snowfalls unequaled in 20 years. The resulting tie-up of rail traffic has restricted the activities of the new railroad administration largely to the issuance of emergency orders to afford immediate relief in the stricken centers. This emergency was also largely responsible for the remarkable order of the fuel administration, stopping manufacturing for five successive days, beginning January 18, and restricting most commercial and industrial activities on each succeeding Monday until March 25.

Some of the measures which have been taken already for the relief of congestion of traffic include an increase in the demurrage charges to a scale ranging from $3 to $10 per day; a material reduction in passenger service on eastern

roads; an order providing that all locomotives built in January, February and March be turned over to eastern roads regardless of the road ordering them, and the institution of a freight-moving week—largely a popular appeal to clean up traffic. Storms, however, interfered seriously with the success of the last measure.

Agitation from a multitude of sources for wage increases has led to the appointment of a wage commission to make a general investigation of the subject, the personnel including Franklin K. Lane, secretary of the interior, chairman; Charles C. McChord, member of the Interstate Commerce Commission; J. Harry Covington, chief justice of the supreme court of the District of Columbia, and Wm. R. Willcox of New York.

RAILWAY ACTIVITIES IN 1917

The Railway Age annual statistical number issued on January 4, 1918, contained a large amount of information regarding the activities of the railways of the United States and Canada in the year recently closed. Railway revenues were shown to have exceeded the four billion dollar mark, about four hundred million dollars more than for 1916, which year in itself established a record. Railway expenses increased even more rapidly, amounting to over $2,800,000,000 in 1917 or nearly five hundred million dollars greater than in 1916. Net revenues from railway operations declined over fifty million dollars in 1917, this decline being most marked in the East where the congestion in traffic has been the greatest.

A total of 979 miles of new lines was completed in the United States and 207 miles in Canada. This mileage of new lines constructed in the United States is less than for any year since the Civil war except 1915 when 933 miles were constructed. The roads also built 613 miles of second track, 36 miles of third track and 28 miles of fourth track in 1917. The largest mileage in any one state was in California which reported 108.89 miles of new line. Alaska came second with 108 miles completed on the Government railway.

For the first time in the history of the American railroads nearly as great a mileage of lines was abandoned or torn up and sold for junk as was built. In 1917 451 miles of railroad was actually taken up or in the process of being taken up and sold for scrap. In addition, operation was abandoned on 491 miles of lines while the owners of 396 miles of other roads asked permission from state commissions or legislatures to abandon operation of those properties.

The mileage of lines in the hands of receivers at the end of 1917 was 17,773. No important railroads went into receivership during the year, while three roads were taken out —the Missouri Pacific, the Pere Marquette and the Chicago, Rock Island & Pacific.

The year 1917 was a record breaker in the aggregate number of locomotives ordered, no less than 7,642 locomotives of all kinds being ordered. The number of locomotives built during the same year was 5,446 and has been exceeded only three times since 1899. Of the locomotives ordered, 2,704 were for the use of railways in the United States and Canada, 2,057 were ordered by the United States government for service overseas and 2,881 were ordered by foreign governments or companies.

The number of freight cars ordered shows a marked decrease in comparison with the similar statistics for the preceding year. A total of 158,965 cars were ordered during the year, of which 74,274 were for domestic use, 18,844 for the United States government for overseas service and 65,676 for France, Russia and other foreign countries. A total of 1,167 passenger cars were ordered, of which 1,124 were for domestic use. This is the smallest number ordered since the records have been compiled, beginning with 1901.

A total of 2,809 miles of road was equipped with block signals during the year, or about 700 miles more than during the preceding year. This brings the total mileage of railway lines equipped with automatic block signals to more than 35,000. At the same time 1,633 miles was reported as under construction and 1,240 miles as proposed for construction during 1918. A total of 187 interlocking plants were also reported built during the year, as compared with 98 during the preceding period.

RAILWAY MEN IN THE ARMY AND NAVY

Statistics compiled by the Railway Age indicate that over 70,000 employees of American railways have already entered the services of the United States in the Great War. Replies to inquiries addressed to all lines have been received from 128 railroads, with a combined mileage of 209,968 miles, or about 80 per cent of the mileage of the United States, and these showed that 55,363 officers and employees had joined the armed forces of the United States, either in the army or the navy, previous to December 1, 1917. Assuming that the same proportionate number of men were supplied by the remaining mileage of the country, the total number of railway men who have joined the colors would be over 70,000. Statistics gathered as to the men who have received commissions show that 1,485 officers and employees on the 128 roads mentioned above have become commissioned officers in the army or the navy. Calculating on the same basis, this would indicate that about 1,800 commissions have been issued to railroad men.

The data received from the various railroads were not sufficiently complete to permit of an analysis of the distribution of the enlisted men and officers among the various railway departments. However, of the list of 1,485 officers, 1,279 were designated by the positions they held in railway service and of these, 430 were members of the engineering and maintenance of way departments. This indicates that among the officers, at least one-third were engineering or maintenance of way men. On individual roads the proportion was much higher than this. On the Baltimore & Ohio over half were engineers or maintenance men and almost one-fourth of the entire valuation department entered military service. The engineering and maintenance department supplied 27 out of 59 officers on the Illinois Central and 16 out of 26 on the New Haven.

Some individual roads were exceptionally heavy contributors to the Nation's military and naval forces. The Pennsylvania system alone has 9,019 men in the army and navy, or about one man to every mile of operated line. Other roads showing heavy enrollment include the New York Central system with 7,143 men, the Santa Fe with 3,000, the Southern Pacific with 2,185, and the Union Pacific System with 2,008.

Below is a list of 22 officers of the engineering and maintenance of way departments of the rank of division engineer or higher who have received commissions in the United States Army:

Name	Position	Railroad	Military Rank
H. C. Booz	Asst. Chief Engr.	P. R. R.	Colonel
F. Jasperson	Engr. Docks & Constr.	P. R. R.	Lieut. Col.
Geo. H. Webb	Chief Engr.	M. C.	Lieut. Col.
H. T. Douglas, Jr.	Chief Engr.	C. & A.	Major
J. A. Given	Div. Engr.	S. P.	Major
B. W. Guppy	Engr. of Struc.	B. & M.	Major
J. B. Jenkins	Val. Engr.	B. & O.	Major
F. G. Jonah	Chief Engr.	St. L.-S. F.	Major
E. B. Morden	Supt. of Constr.	G. N.	Major
G. M. Rice	Div. Engr.	C. M. & St. P.	Major
Jos. W. Williams	Chief Engr.	N. W. Pac.	Major
W. G. Arn	Asst. E. M. of W.	I. C.	Captain
Richard Brooke	Div. Engr.	B. & O.	Captain
Franz A. Busse	Bridge Engr.	L. & N.	Captain
R. A. Cook	Val. Engr.	C. & A.	Captain
T. W. Fatherson	Engr. M. of W.	C. G. W.	Captain
E. A. Froyd	Chief Engr.	T. P. & W.	Captain
J. W. Reid	Bridge Engr.	C. & A.	Captain
B. J. Simmons	Div. Engr.	A. T. & S. F.	Captain
C. F. Hinchman	Engr. M of W.	C.C.C. & S.L.	First Lieut.
Thos. W. Saul	Div. Engr.	O. W. R. & N.	First Lieut.
C. K. Smith	Bridge Engr.	S. P. & S.	First Lieut.

PERSONAL MENTION

GENERAL

Arthur W. Thompson, vice-president of the Baltimore & Ohio, in charge of traffic and commercial development, with headquarters at Baltimore, Md., has had his authority extended over the operating and engineering departments.

J. A. Campbell, supervisor of bridges and buildings on the Tacoma division of the Northern Pacific, with office at Tacoma, Wash., has been appointed trainmaster, with the same headquarters, succeeding **C. W. Fee,** who has entered government service.

Arthur C. Needles, who has been promoted from general manager to vice-president, in charge of operation, of the Norfolk & Western, with office at Roanoke, Va., began railway work as a rodman on the Washington, Ohio & Southern in 1882. A year later he became a rodman in the engineering department of the Norfolk & Western. Since that time he has been in continuous service with this road, serving successively as yard clerk, brakeman, night and day yardmaster, assistant trainmaster, trainmaster, assistant superintendent, superintendent, general superintendent and general manager, holding the last named when recently promoted.

A. W. Johnston, who has retired as assistant to the president of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, received his early training in the engineering department. He was born at Boston, Mass., on March 4, 1853, and graduated from the Massachusetts Institute of Technology, entering railway service in July, 1875, as a clerk in the office of the general superintendent of the Pittsburgh, Cincinnati & St. Louis. Later he was made assistant engineer on this road, following which he was superintendent of an industrial corporation in Arizona, chief engineer of the Toledo, Delphos & Burlington, and superintendent of the Leavenworth, Topeka & Southwestern. He went to the Nickel Plate in April, 1884, and served successively as division engineer, division superintendent, general superintendent, general manager and assistant to the president. He was president of the American Railway Engineering Association for the year 1907-8.

ENGINEERING

W. O. Galbreath has been appointed chief engineer of the Missouri, Oklahoma & Gulf, with office at Muskogee, Okla., succeeding **N. C. Van Natta.**

J. M. Roeschlaub, resident engineer of the Denver & Salt Lake, with headquarters at Denver, Colo., has been appointed chief engineer, with the same headquarters.

F. E. Kurzenknabe, engineer and supervisor of the Lexington yards of the Louisville & Nashville, has resigned to accept a position as highway engineer and manager of the Faytee County road department, Lexington, Ky.

J. D'Esposito, assistant chief engineer of the Chicago Union Station Company, Chicago, has gone to Washington to become associated with the Emergency Fleet Corporation. **A. J. Hammond,** principal assistant engineer, has assumed the duties of Mr. D'Esposito at Chicago.

W. B. McArdle has been appointed division engineer of the Central New England, with headquarters at Poughkeepsie, N. Y., succeeding **J. H. Gallivan,** who has been transferred to the Middle division of the New York, New Haven & Hartford, with office at Boston, Mass.

F. M. Seifer, division engineer of the Portland division of the Southern Pacific, has been transferred to the Sacramento division, with headquarters at Sacramento, Cal., succeeding **W. H. Kirkbride. H. M. Lull** succeeds Mr. Seifer as division engineer of the Portland division.

William Gerig, consulting engineer of the Alaskan Engineering Commission, has been appointed engineer in charge of the Anchorage division of the Alaska Railroad, under the supervision of William G. Edes, chairman of the Commission. Previous to his connection with the Commission he was vice-president and chief engineer of one of the Hill lines in the Northwest and prior to that was engineer in charge of a construction division on the Panama Canal.

J. A. Heaman, whose appointment as assistant chief engineer of the Grand Trunk Pacific, with headquarters at Winnipeg, Man., was announced in the December issue, was born at Memphis, Tenn., on June 3, 1874. He graduated from the Collegiate Institute, London, Ont., and in 1902 from McGill University, Montreal, Que. He served as an articled pupil to Moore & Henry, engineers and surveyors, London, Ont., from 1893 to 1898. He entered the service of the Grand Trunk in April, 1901, as instrumentman, was made resident engineer in 1902 at Oshawa, Ont., and assistant resident engineer at Toronto, Ont., in 1903. From 1903 to 1905 he was assistant engineer in charge of a location party on the National Transcontinental, east of Winnipeg, and the next year was made division engineer in charge of some new work, east of Winnipeg. He next became assistant district engineer on the Grand Trunk Pacific at Kenora, Ont., where he remained till 1908, when he became assistant district engineer at Winnipeg, as well as at Kenora. In 1912 he was made office engineer at Winnipeg and the same year division engineer at Jasper, Alta. For the next five years he was assistant to the chief engineer at Winnipeg, and in November, 1917, was made assistant chief engineer.

J. A. HEAMAN

TRACK

E. F. Mulkern, section foreman on the Havre division of the Great Northern, has been appointed an assistant roadmaster on the same division, with headquarters at Havre, Mont., succeeding **James Sullivan,** who has resigned.

T. R. Connors, division roadmaster on the Marcus division of the Great Northern, with headquarters at Marcus, Wash., has been transferred to the Butte division, with headquarters at Great Falls, Mont., succeeding **U. Sowa,** who has been appointed assistant roadmaster of the Butte division. **Nels Johnson,** assistant roadmaster on the Butte division, succeeds Mr. Connors at Marcus.

M. Canavan, who has been appointed roadmaster of the second district of the Salt Lake division of the Denver & Rio Grande, with headquarters at Provo, Utah, succeeding **C. Nelson,** resigned, entered railway service as a section laborer for the Union Pacific in March, 1907. The next year he was made foreman in charge of a terminal yard and in June, 1911, he was promoted to extra gang foreman. In May, 1912, he was appointed acting roadmaster of the sixth district of the same road, where he remained until July of the same year, when he was made assistant roadmaster on the fifth district. In March, 1913, he was made general foreman at the Sherman Hill gravel pit and on June 30, 1913, he resigned to enter service with the Denver & Salt Lake, becoming roadmaster on the first district. He was later transferred to the second and third districts and in September, 1913, he had charge also of a 40-mile extension. On January 1, 1918, he resigned to become roadmaster on the Denver & Rio Grande.

J. V. Donielson, whose appointment as roadmaster on the Sheridan division of the Chicago, Burlington & Quincy, with headquarters at Sheridan, Wyo., was announced in the January issue, entered service with the Chicago, Burlington & Quincy in January, 1890, as a section laborer. He remained in this position for three years when he was made section foreman, with headquarters at Gordon, Neb. From June, 1895, to December, 1896, he worked as a bridge carpenter at Edgemont, S. D., after which he again became a section foreman at Sheridan, Wyo., where he remained until 1908, when he was made extra gang foreman. From 1909 until 1916 he was roadmaster at Sheridan. In the latter year he was made yard foreman. He remained in this position a year when he was again made roadmaster at Sheridan.

A. J. Barbee, who has been appointed roadmaster on the Black Hills line, Iowa and Dakota division, of the Chicago, Milwaukee & St. Paul, with headquarters at Murdo-Mackenzie, S. D., began railway service with this road as a section laborer at Newtown, Mo., in August, 1895. In August, 1900, he was appointed assistant extra gang foreman, a position he held until June 11, 1901, when he was made section foreman at Elmira, Mo. He remained in this capacity, being transferred to a number of points, until 1903, when he was put in charge of an extra gang on the west end of the Kansas City division, where he remained until 1905, when he took charge of the Mystic yards on this same division, remaining there until July, 1907, when he was made steel gang foreman. In 1912 he became steel gang foreman on the Chicago and Council Bluffs division in Iowa, and, after work of this kind on various divisions, he was appointed assistant roadmaster on the Milwaukee terminals in 1917, which position he held when appointed roadmaster.

BRIDGE

Ernest S. Draper has been appointed engineer of structures of the Boston & Albany, with headquarters at Boston, Mass., succeeding **A. D. Case,** who has resigned to become structural engineer in charge of the structural division of the American International Shipbuilding Corporation.

H. A. Cameron has been appointed chief carpenter of the Dubuque division of the Chicago, Milwaukee & St. Paul, with headquarters at Dubuque Shops, Iowa, succeeding **Gunner Tornes,** who has been appointed acting chief carpenter of the Black Hills division and the west end of the Iowa and Dakota division, with headquarters at Mitchell, S. D. Mr. Tornes succeeds **H. R. Drum,** who has been temporarily disabled.

D. L. Rehmert has been promoted to master carpenter on the Pennsylvania Lines West, with headquarters at Bradford, Ohio, succeeding **Stanton Bowers,** who has resigned. He entered railway service as a house carpenter on the Indianapolis division of the Pittsburgh, Cincinnati, Chicago & St. Louis in October, 1902, where he remained until October, 1906, when he was promoted to carpenter foreman on the Columbus terminals. He held this position until his recent promotion, as noted above.

PURCHASING

A. Gerrard has been appointed material agent and assistant purchasing agent of the Missouri, Oklahoma & Gulf, with headquarters at Muskogee, Okla.

George M. Shriver, vice-president of the Baltimore & Ohio, in charge of accounting, treasury, claim and relief departments, with headquarters at Baltimore, Md., has had

IN MILITARY SERVICE

William A. Christian, senior civil engineer, and **T. F. Laist,** senior architect of the Division of Valuation of the Interstate Commerce Commission, Central district, Chicago, have received commissions as majors in the engineering corps of the United States army. **J. M. Kemmerer,** office engineer at Chicago, has been made a captain.

SUPPLY TRADE NEWS

GENERAL

The Concrete Mixing & Placing Company has moved its offices from 123 West Madison street, Chicago, to the First National Bank building in the same city.

The P. & M. Company, Chicago, has established a southwestern sales office in the Railway Exchange building, St. Louis, Mo., with W. H. Reaves in charge. Mr. Reaves has been with this company for the past year.

The American Sheet & Tin Plate Company, Pittsburgh, Pa., on January 1, had a total of 1,417 men in the various branches of the military service of the United States. To draw attention to this fact, the company has pasted on its letterheads a sticker made up like a service flag and containing the name of the company, a star and the figures 1,417.

PERSONAL

Frank L. Brown, president of the Ransome Concrete Machinery Company, New York, died of heart disease at his home on January 2. He was 57 years old.

J. H. Sharp has been appointed western representative of the Glazier Manufacturing Company, with headquarters in the McCormick building, Chicago.

S. D. Winger, formerly associated with the Prest-O-Lite Company, in charge of railroad sales, has been appointed general manager of the compressed acetylene department of the Oxweld Railway Service Company, with office at Chicago.

Frank Bartholomew, who was erecting engineer for the Shaw Electric Crane Company for 20 years, has resigned his position with that company to become associated with N. B. Payne, New York, specialist in electric cranes.

H. M. Aubrey, formerly with the Quaker City Rubber Company and the H. W. Johns-Manville Company, has been appointed special packing representative of the Union Supply Company, with headquarters at Chicago.

E. K. Carter, representative of the Standard Asphalt & Refining Company, Chicago, has received a commission as captain in the Engineer Officers' Reserve Corps, reporting for active duty at Camp Lee, Petersburg, Va., on January 5.

I. R. Garretson, lumber agent of the Chicago & Eastern Illinois, was appointed traffic manager of the Marsh & Truman Lumber Company, Chicago, on January 1, to succeed **A. F. Marsh** and **F. L. Bronez,** who have entered United States army service.

J. E. Buckingham, western representative of the Standard Steel Works Company, with offices in the Northwest Bank building, Portland, Ore., was appointed assistant general manager of the Hofius Steel & Equipment Company, Seattle, Wash., on January 1.

Russell T. Gray, formerly advertising manager of the Haynes Automobile Company and more recently secretary of the Shuman Advertising Company, Chicago, has opened an office in the First National Bank building, Chicago, as an advertising engineer. Among his clients are the Chicago Malleable Castings Company and the Interstate Iron & Steel Company, both of Chicago.

Ralph C. Davison, who has been connected with the American Mason Safety Tread Company, New York, in a selling and engineering capacity for the past six years, has resigned his position and directorship with this company to go with the American Abrasive Metals Company, makers of Feralun Safety Treads and Anti-Slip Surfaces. Mr. Davison was at one time an associate editor of the Railroad Gazette.

P. C. Gunion, formerly manager of the Pittsburgh office of the Hyatt Roller Bearing Company, Newark, N. J., has been appointed advertising manager of the industrial bearings division. Mr. Gunion was in the sales department of this company for two years previous to the above appointment. **D. Gleisen,** assistant manager, in charge of the bushings sales, has been appointed manager of the industrial bearings division. He is a graduate mechanical engineer of Stevens Institute and has been connected with the Hyatt Company for the past six years.

Charles V. Eades, who recently resigned as sales manager and engineer of the asphalt product department of the lished a company called the Mineral Rubber Products Company, with offices at 280 Madison avenue, New York City. The company will handle materials and will contract for floors, waterproofing, insulation, expansion specialities, protective coatings, etc., as well as represent other well-known manufacturers. One of the special products which this company has put on the market is a moisture-proof concrete block, designed by Mr. Eades.

Bertrand H. Wait has entered the employ of the Portland Cement Association, and on February 1 will take up his duties with the association as district engineer, in charge of the New York office. Mr. Wait graduated from Cornell University in 1902 with the degree of civil engineer. In 1903 he was appointed assistant engineer with the Rapid Transit Subway Commission, New York, and remained on this work until 1907, when he was transferred to the Board of Water Supply of the City of New York. In 1911 he was transferred to the City Aqueduct Department as assistant division engineer of the Bronx division, and in August of that year he was made division engineer. In 1913 he resigned to accept the appointment as division engineer, New York State Highway Department, in charge of Division No. 1, which consisted of ten counties adjoining New York City. During the past year Mr. Wait has also served as consulting engineer for the United States Government on cantonment road construction.

R. A. Van Houten, works manager of the Sellers Manufacturing Company, Chicago, has been promoted to vice-president and general manager, with the same headquarters. He entered railway service with the Erie in March, 1887, serving consecutively as chainman and rodman on the New York division for two years; rodman for the chief engineer for the next two years; assistant engineer of the New York division for 7½ years, and division engineer for the Delaware division for the next 8 years. In June, 1908, he became division engineer of the New Jersey and Lehigh division of the Lehigh Valley, where he remained until October, 1912, when he became eastern sales agent for the Sellers Manufacturing Company, with headquarters at New York. He remained seven months in New York when he was transferred to the sales department at Chicago. In April, 1917, he was appointed works manager of the plant at Mayfair, Ill., where he remained until January 1, when he was appointed vice-president. **George M. Hogan,** sales agent of the Sellers Manufacturing Company, has been appointed assistant secretary, and **W. H. Seigmund,** cashier, has been appointed assistant treasurer, relieving **E. M. Kerwin,** secretary-treasurer, who has been granted a leave of absence to enter military service, having been commissioned a captain in the ordnance department and stationed at Washington, D. C.

R. A. VAN HOUTEN

Edward M. Hagar, president of the American International Steel Corporation, a subsidiary of the American International Corporation, and former head of the Martin-Wright Aeroplane Company and the Universal Portland Cement Company, died January 18, from pneumonia at his home in New York. Mr. Hagar was born in Salem, Mass., 45 years ago. He was educated at the Massachusetts Institute of Technology and at Cornell. Going to Chicago, he became president of the Universal Portland Cement Company, serving 15 years in that capacity, and resigned to become president of the Wright-Martin Company. He became president of the American International Steel Corporation last June.

TRADE PUBLICATIONS

Reinforcing Bars.—The Cambria Steel Company, Philadelphia, has issued a 24-page illustrated booklet describing the Cambria Slick concrete reinforcing bar. This booklet contains detailed information concerning the properties of this bar and data of value in designing structures.

Hydrated Lime.—The Hydrated Lime Bureau of the National Lime Manufacturers' Association, Pittsburgh, Pa., has issued a 24-page pamphlet, entitled "Watertight Concrete," which is devoted to the discussion of the properties of hydrated lime in making concrete impermeable to water. The pamphlet contains a large amount of information regarding this material and is illustrated with photographs of structures in which hydrated lime has been used.

Steel Products.—The Carnegie Steel Company has issued a small pamphlet, entitled "My Dear Jim," which is in the form of a letter from a retired steel man to a friend in Medicine Hat. In it the writer presumes to tell his friend of the development in the steel industry during recent years. To put this in a logical form, the letter follows the general outline of the contents of the Carnegie Shape Book and goes into detail concerning the more recent additions to the various rolled shapes, explaining the industrial and trade conditions which demanded the manufacture of the newer sections. Through this means a large amount of valuable information is presented in an interesting manner.

CONSTRUCTION NEWS

The Atchison, Topeka & Santa Fe is preparing plans for terminal improvements at Tulsa, Okla., to cost approximately $800,000.

The Great Northern is building an extension to its dock at Seattle, Wash., at a cost of about $50,000. Grant Smith & Company, St. Paul, Minn., have the contract for the work.

The Gulf, Colorado & Santa Fe will sink a well and make other improvements to its present water facilities at Kirbyville, Tex., at an estimated cost of about $6,000.

The Illinois Central has purchased 83 acres of land east of its new line and south of 171st street, Chicago, which will be used for new yards.

The Philadelphia & Reading has given a contract to the William Steele & Sons Company, Philadelphia, Pa., to build a steel and concrete roundhouse at Philadelphia, containing 10 stalls 90 ft. long and 6 stalls 110 ft. long, also a machine shop of irregular shape. The latter will be 130 ft. wide at one end and 156 ft. 6 in. at the other by 216 ft. 7 in. long. The cost of the work will be about $326,183.

The Southern Pacific plans to remodel its timber preserving plant at West Oakland, Cal., at an estimated expenditure of $350,000. The improvement includes the reconstruction of the track layout, the filling of a portion of the bay to provide room for expansion and the new installation of modern timber treating equipment.

The Tampa Southern has awarded contracts to E. W. Parker, Tampa, Fla., and Baxter Morrison, Inverness, to build a line from Tampa south to Palmetto. It is planned to build the line further south from Manatec to Sarasota, making the total distance 57 miles.